

A PILOT STUDY TO EVALUATE THE POTENTIAL AND VALUE FOR ENHANCED OPERATIONS AND PROJECT MANAGEMENT LEARNING IN OMANI COMPANIES

DAVID G. OWEN¹ & TAHSEEN ARSHI²

¹University of Bedfordshire, Luton, Bedfordshire, United Kingdom

²Majan College, Muscat, Oman

ABSTRACT

The aim of this paper is to gain insights into the potential for enhanced Operations and Project Management learning in Omani companies. Using a pilot study of Omani managers, insights are drawn into the current strategic status that operations has within Omani companies in the private and public sector and the potential that it has to enable competitive advantage and advance the diversification of the Omani economy. The unit of analysis are selected Omani managers in the Muscat area as well as past or present students on the University of Bedfordshire's MBA programme which is delivered in partnership with Majan College in Oman. The authors conclude that overall, Omani companies do not appear to be advanced in the use of quality systems compared with European companies and therefore there is potential to improve this situation via the teaching of Operations Management courses such as that offered by the UoB MBA.

Most of the literature around the strategic status of operations is based around work done by Hayes and Wheelwright (1985) and focuses on manufacturing and production but there is limited literature on the strategic status of service operations and there is also little literature on the status of operations capabilities within developing countries. Therefore this paper is of value to managers in developing countries and other educators who wish to consider the design of operations and project management courses and adds to the extant body of knowledge as an empirical case.

KEYWORDS: Operations Management, MBA, Hayes and Wheelwright, Quality Tools, Competitive Advantage

1. INTRODUCTION

Slack et al (2010) define Operations Management (OM) as the activity of managing the resources which produce and deliver products and services. They note that all organizations have an operations function although not all types of organization may call the operations function by this name. In some organizations the operations manager might be called the 'fleet manager' in a distribution company, the 'administrative manager' in a hospital, or the 'store manager' in a supermarket. Wild (1971) defines 4 operations classifications:

- Manufacturing operations: these result in a change in form (the conversion or assembly of raw materials)
- Supply operations: these result in a change in possession
- Transport operations: these result in a change in place
- Service operations: these result in a change of state (usually of a customer)

Slack et al (2010) note that OM uses the organization's resources to create outputs that fulfil defined market requirements and that this is the fundamental activity of any type of enterprise. They also note that the current business

environment is changing rapidly with growing cost based pressures, increased globalisation, higher customer quality expectations and demands and rapidly developing technologies. Slack et al (2010) note that most companies are now looking to the OM function to allow them to navigate this new environment successfully thereby adding to the relevance of this paper which seeks to investigate the status of operations management capabilities in a developing country, Oman.

Oman’s economy has long been dependent on hydrocarbons, and activities in that sector accounted for 30% of GDP in 2012. (Oxford Business Group, 2014). The Omani government is seeking economic diversification as one strategy to counter depleting hydrocarbon reserves and this involves moving towards a knowledge-based, service-oriented economy and also emphasises developing several non-hydrocarbons sectors, including industry, tourism and agriculture. All of these aims would be facilitated by strong OM capabilities in Omani companies and this paper seeks to audit the current state of capabilities and to consider whether they could be improved by more OM learning.

Hayes and Wheelwright (1985) were one of the first authors to consider companies competing successfully through OM although their focus was on manufacturing. They developed a four stage model for analyzing the strategic role of the manufacturing function of a company with each stage exhibiting different characteristics as shown in Figure 1 below.

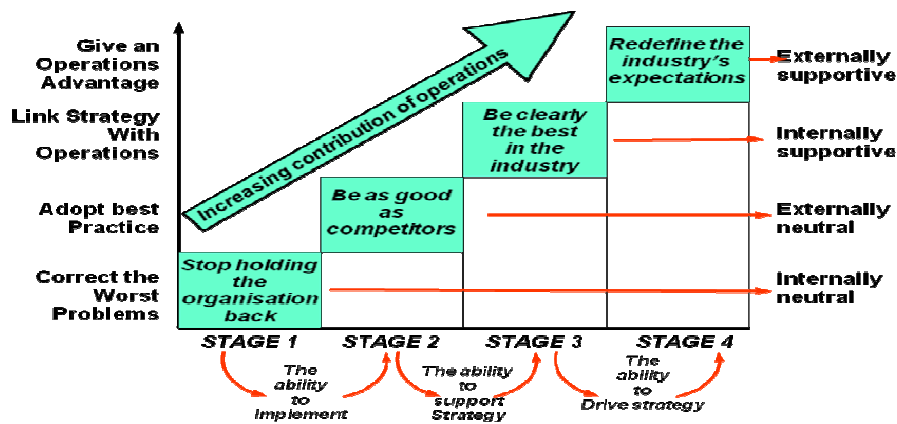


Figure 1: The Hayes-Wheelwright 4-Stage Model of the Strategic Role of Operations (Slack, 2010)

The model traces the progression of the operations function from what is the largely negative role of stage 1 operations to its becoming the central element of competitive strategy in excellent stage 4 operations. Hayes and Wheelwright (1985) noted that a company’s position at any stage along the continuum can ascend or descend from one stage to another.

Stage 1: Internal Neutrality: This is the most minimal level of contribution by the operations function. Its aim is simply not to hold the company back from competing effectively and top management believes that manufacturing cannot influence the competitive success of the organization. It is inward-looking with manufacturing managers spending most of their time in managing day-to-day concerns such as machine breakdown, quality and delivery problems, productivity and supplier related problems. They consider themselves as incapable in making the right strategic manufacturing decisions and seek help from outside whenever the situation arises. The OM function attempts to improve by ‘avoiding making mistakes’ and top management believe that the manufacturing capability of the organization can only be enhanced by investing in new equipment and technologies and gives little emphasis to improving infrastructure such as planning and measurement systems and work force policies.

Stage 2: External Neutrality: Slack et al (2010) note that the first step of breaking out of stage 1 is for the operations function to begin comparing itself with similar companies or organizations in the outside market (being 'externally neutral'). This may not immediately take it to the 'first division' of companies in the market, but at least it is measuring itself against its competitors' performance and trying to implement 'best practice'. Management emphasizes productivity enhancement and economies of scale and following standard practices. They consider capital investments as the favoured means for gaining competitive advantage and they rely on sources outside manufacturing to provide improvements in their processes.

Stage 3: Internally Supportive: Stage 3 operations are amongst the best in their market and in these organizations, management recognizes the value of having a manufacturing strategy. They achieve this by gaining a clear view of the company's competitive or strategic goals and supporting it by developing appropriate operations resources. The operation is trying to be 'internally supportive' by providing a credible operations strategy.

Stage 4: Externally Supportive: Here the company views the operations function as providing the foundation for its competitive success. Operations look to the long term. It forecasts likely changes in markets and supply, and it develops the operations-based capabilities which will be required to compete in future market conditions. Stage 4 operations are innovative, creative and proactive and are driving the company's strategy by being 'one step ahead' of competitors— what Hayes and Wheelwright call 'being externally supportive'.

Some authors have attempted to test and operationalize the Hayes and Wheelwright (1985) four stage model. Hum and Leow (1996) made a questionnaire based on the characteristics of stages 2 and 4 of the model and tested it with the manufacturing operations of 55 Singaporean electronic companies. They assigned an overall stage for the industry sector studied to lie between stages 2 and 3. Hum (2000) also applied the model to a service context studying the Singaporean third party logistics companies. Dangayach and Deshmukh (2003) assessed the stages of four industry sectors in India according to the Hayes and Wheelwright (H-W) model and using the average score, they found that these were predominantly in stage 2.

Barnes and Rowbotham (2004) developed a questionnaire to classify an organization's operation according to H-W's four stage model and tested its usefulness as a research instrument. They conducted a survey among practicing managers in UK from both manufacturing and service organizations. They found that only about half of the respondents could provide an assessment of their organization's operation that was consistent with the logic of H-W model and therefore they questioned the applicability of the model in UK context. Rowbotham and Barnes (2004) formulated questionnaire to classify the manufacturing companies according to different stages of the H-W model and applied it to three small manufacturing companies. They checked, for the first time, the reliability of 30 questions according to inter-class correlation method where half of their questions were not found to be statistically reliable. They suggested further research to develop a more reliable questionnaire for exploring the four stage concept.

Jain et al. (2013) attempted to overcome the problems noted in using the H-W model by re-examining the original paper by Hayes and Wheelwright (1985) and grouping the questions into 4 "catalysts for change". They also included an additional question linked to Workforce Management linked to the work of Chase and Hayes (1991). They tested their questionnaire with managers from 28 manufacturing units.

Thus, it is evident from the literature that even though H-W's four stage model is very popular and widely accepted among academicians, its application in real life has been limited possibly due to the non-availability of a reliable instrument capturing H-W concept.

This paper attempts to overcome this hurdle by using aspects of previous instruments that were validated and by also considering the work of De Sousa et al (2005) who evaluated the use of quality tools and techniques in Portuguese Small and Medium Enterprises (SMEs) as an alternative way of evaluating the operations management capabilities of Omani companies. De Sousa et al (2005) defined SMEs based on European Union (Commission of the European Communities, 2001), constraints as those companies:

- With less than 250 workers,
- With no more than 25% of the capital or voting rights being held by one or more enterprises which were not, themselves, SMEs; and
- The annual turnover was less than E7 million (~4 million Rials) for small enterprises and less than E40 million (~21 million Rials) for medium enterprises or the total balance sheet was less than E5 million (~3 million Rials) for small enterprises and less than E27 million (~14 million Rials) for medium enterprises.

The two main objectives of the pilot study were:

- To address the following research questions:
 - At which stage/s do Omani companies lie on the Hayes and Wheelwright model of the strategic role of operations?
 - What are the most widely undertaken quality initiatives done by Omani companies?
 - How widely used by Omani companies are operations management quality tools and techniques?
 - Are there any differences between Omani private sector and public sector companies with respect to quality initiatives undertaken and quality tools and techniques preferred?
 - Are there any differences between Omani manufacturing and service companies with respect to quality initiatives undertaken and quality tools and techniques preferred?
- To secure feedback to improve the design of the questionnaire

2. BACKGROUND ON THE UNIVERSITY OF BEDFORDSHIRE'S (UOB'S) DL MBA

The 15-credit Operations and Project Management (OPM) unit makes up one of the 9 units on the UOB's DL where students are recruited by a local overseas centre partner and then receive the bulk of their learning experience in an online DL mode from the UoB. (Bentley et al, 2010). However, in each of the 2 years that comprise the MBA, students attend 4 Weekend Business Schools at the local centre where they are given face-to-face classes from local centre tutors, and in the first of these Business Schools, students are also given introductory unit classes by UOB staff that fly out to the local centre. This paper considers the UoB's MBA in Oman which is run jointly with the UoB's local partner, Majan College.

The UK UOB lecturers are in charge of delivering the online course materials via a VLE called Breo which is powered by Blackboard. They are also responsible for designing and marking the assignments for each module. Assignments are submitted via a Turnitin facility on BREO which also aims to check student work for improper citation and potential plagiarism (Turnitin, n.d).

The main topics covered by the OPM unit include:

- **The Nature of Operations**
 - What are operations and how can they be classified?
- **Business Strategy And Global Competitiveness**
 - How can operations support the business strategy and mission?
 - Which of the 5 performance objectives must it especially focus on?
 - How global are our markets and how should it organise to service them with respect to outsourcing, vertical integration and the supply chain?
- **Quality Management**
 - Which quality methods are relevant for monitoring and improving our operations?
 - Which quality standards need to be developed and maintained?
- **Product/Service Design**
 - What are the key factors involved in the management of a new product and service design (NPSD) process?
- **Transformation System Design**
 - What do our operations' characteristics (e.g. volume and variety) imply for the processes, material flow, equipment and technology we should use?
 - Can existing systems be improved by Business Process Re-engineering?
- **Capacity Planning**
 - How much capacity do we need to have available to meet forecast market demand?
 - How can we manage our capacity to meet fluctuating (e.g. seasonal) demand?
- **Location Planning**
 - Where should we put our production, storage and other major facilities?
 - On what criteria should we base the location decision?
- **Schedule Management**
 - How should we organise our resources such that that the right tasks are conducted:
 - at the right time

- on the right items
 - to produce the right output.
- **Supply Chain Management**
 - How do we organise activities from the customer's order through to final delivery for speed, efficiency and quality?
 - Should we make or buy this component? What should we outsource?
 - What are our criteria for selecting suppliers and how can we improve our purchasing efficiency?
 - Can our suppliers integrate into our supply chain IT systems and our e-commerce programme?
- **Inventory Management**
 - How much inventory of each item should we have?
 - When do we re-order? And how much should we reorder?
 - Can we prioritise our inventory requirements?
- **Materials Requirement Planning**
 - Should we use an MRP information management system to order, schedule production and manage our inventory based on a master production schedule?
 - Should we use an Enterprise Resource Planning (ERP) system to integrate inputs and outputs of our MRP production system with other dependent functions within our organisation, as well as with suppliers and customers external to the organisation?
- **Just-in-Time ("JIT") Systems**
 - Can we use any JIT techniques to eliminate waste and non-value-added activities?
 - Can we use Total Productive Maintenance?
 - How far can we approach the JIT ideal of making to order and zero inventory?
- **Project Management**
 - How can we plan and control project activities to meet specifications for performance, schedule and cost?

3. METHODOLOGY

The research addresses the research questions described earlier. The unit of analysis is selected Omani managers in the Muscat area as well as past or present students on the UoB's MBA programme which is delivered in partnership with Majan College in Oman.

The primary research method used was a questionnaire survey. This was initially based on an earlier validated survey by Rowbottom and Barnes (2004) and used only the 50% of the questions that they found to be statistically reliable. These questions were then edited by replacing "manufacturing" with "operations management" in order to make them

relevant for both manufacturing and service companies. The questionnaire was further extended to include an additional question linked to Workforce Management suggested by Jain et al. (2013). Additionally, it was also extended to include the validated questions on “quality initiatives” and “operations management quality tools and techniques” given in the work of De Sousa et al (2005).

Table 5 shows the 21 questions which were used to address research question 1 where a 5-point scale was used with 1= “Strongly Disagree”, 2 = “Disagree”, 3 = “Uncertain”, 4 = “Agree”, 5 = “Strongly Agree”. Rowbottom and Barnes (2004) classified each statement into a stage on the basis that a positive response to it is recognising this feature as present in the company concerned. The statements used were classified within the Hayes and Wheelwright (1985) four-stage model as follows:

- Stage 1: Questions 1, 2, 3 and 6 of Table 5.
- Stage 2: Questions 4 to 6 of Table 5.
- Stage 3: Questions 7 to 9 of Table 5.
- Stage 4: Questions 9 to 17 of Table 5.

Rowbottom and Barnes (2004) suggested the following guidelines to interpret the scores based on the above 5-point scale:

- 4 and above – definite agreement with a stage
- above 3 but less than 4 – suggesting a weaker positive identification of a stage
- 3 – neutral
- less than 3 – definite disagreement with a stage

Similarly, Jain et al (2013) noted that the 4 Workforce related questions (Questions 18 to 21 in Table 5) were related to the 4-stage model in the following manner:

- Score of 4 and above for “Worker is tightly controlled” suggests Stage 1
- Score of 4 and above for “Worker follows set procedures” suggests Stage 2
- Score of 4 and above for “Worker is permitted to choose from a number of alternative procedures” suggests Stage 3
- Score of 4 and above for “Worker is encouraged to develop innovative new ways of working” suggests Stage 4

In order to use the above guidelines it was decided to take the average of the values obtained for all the questions linked to the stage as there was no definite guidance on how to determine the score for each stage.

There were 43 survey questions addressing the research questions 2, 4 and 5 based on the previously validated questions of D’Souza et al (2005) and these are shown in Table 4. Finally, there were 40 survey questions addressing research questions 3, 4 and 5 based on the previously validated questions of D’Souza et al (2005) and these are shown in Table 7. Here questions linked to the degree of use of quality tools were recorded using a 5-point scale, where 1 = “Very Low”, 2 = “Low”, 3 = “Moderate”, 4 = “High” and 5 = “Very High.”

A snowball method was used to promote the online questionnaire to Omani managers starting with MBA students currently studying with Majan College (“Majan”). A total of 62 responses were received but 6 of these were rejected because they were incompletely filled in and a further 40 were rejected because the respondents were not managers at their companies.

The current research is being treated as a pilot study to secure insights to the research questions as well as to identify whether the questionnaire may need to be further adapted before a larger main survey is undertaken.

4. RESULTS

4.1 Evaluation of the Respondents

The job roles of the 16 respondents used in the pilot study are shown in Figure 2 while Table 1 summarises some of their other details.



Figure 2: Job Roles of Respondents

Table 1 shows that the Majan and non-Majan student respondents were similar in nature except that the non-Majan students had been at their present companies slightly longer than the Majan students. There was not enough data to do a t-test and therefore all the respondents were treated as a single group.

Table 1: Summary of Respondent Details

	Gender		Age				Number of Years with Present Company				
	Male	Female	18-25 yrs.	26-35 yrs.	36-45 yrs.	>45 yrs.	<1 yr.	1-3 yrs.	3-5 yrs.	6-10 yrs.	>10 yrs.
Current Majan Student	2	0	0	2	0	0	0	1	1	0	0
Past Majan Student	5	1	4	1	1	0	1	2	3	0	0
Non-Majan Student	3	5	3	3	2	0	0	1	2	2	1

5.2 Company Profiles

Table 2 shows the profile of the respondent companies considered in this pilot survey while Table 3 provides further details of the respondents’ companies. It may be seen that ~60% of the companies were SMEs making a comparison of the results from this study meaningful when compared with the SME results obtained by D’Souza et al (2005).

Table 2: Classification of Companies Used in the Survey

Industry Sector	Private Sector	Public Sector	Manufacturing ^(*)	Services ^(*)
Oil and Gas	1	1	2	0
Banking	1	1	0	2
Finance	0	1	0	1
Real Estate	1	0	0	1
Tourism	1	1	0	2
Telecommunications	1	0	0	1
Construction	3	0	3	0
Logistics ^(**)	1	0	0	1
Education	1	1	0	2
Consultancy	1	0	0	1
TOTALS	11	5	5	11

* Based on the Operations Management classifications given by Wild (1971)
 ** According to the Operations Management classifications given by Wild (1971), this is a Supply operation but for the purposes of this study it is treated as a Service operation.

Table 3: Summary of Company Profiles Considered in the Survey

Company Classification	SME Status as Defined by De Sousa (2005)			Ownership Status					Number of External Customers in the Last Financial Year			
	SME	Turnover >21M Rials	Unsure of Status	100% Govt. Owned	61-99% Govt. Owned	40-60% Govt. Owned	100% Omani Owned	Family Ownership	<3	3 - 10	11- 25	>25
Private	8	1	2	0	1	1	6	5	2	1	3	5
Public	1	1	3	2	1	1	0	1	1	2	1	1
Manufacturing	3	1	1	0	0	1	2	3	1	0	1	3
Service	6	1	4	2	2	1	4	3	2	3	3	3
Total	9	2	5	2	2	2	6	6	3	3	4	6

4.3 Main Results

4.3.1 Quality Initiatives

Table 4: Summary of Quality Initiatives Undertaken by Omani Companies (Results Show Number of Responses)

	Private Sector	Public Sector	Manufacturing	Services	Total
<i>To which quality assurance system is your company certified (if any)?</i>					
1. ISO 9000	3	1	3	1	4
2. CMMI	0	2	0	2	2
3. Other: Please specify:	0	0	0	0	0
4. We are not certified with a quality assurance system as yet	8	2	2	8	10
<i>If certified, please state when the certificate was attained?</i>					
5. within the last year	0	0	0	0	0
6. in the last 1-3 years	1	3	1	3	4
7. in the last 3-5 years	0	0	0	0	0
8. in the last 5-10 years	1	0	1	0	1

9. more than 10 years ago	1	0	1	0	1
10. We are not certified with a quality assurance system as yet	8	2	2	8	10
<i>Which of the following quality initiatives has your company implemented?</i>					
11. Setting up a Quality Department	7	4	3	8	11
12. Applying Statistical Process Control	5	4	2	7	9
13. Business Process Improvement	5	4	3	6	9
14. Employee involvement to improve quality	6	4	2	8	10
15. Cultural change programme	2	2	1	3	4
16. Establishing measures of quality progress	4	3	2	5	7
17. Customer satisfaction initiatives	6	2	2	6	8
18. Developing strategies for total quality	5	3	3	5	8
19. Supplier involvement programme	5	3	3	5	8
20. We have not implemented any of the quality initiatives as yet	4	2	2	4	6
<i>When were the following quality initiatives in your company implemented?</i>					
21. Setting up a Quality Department					
<1 yr.	1	1	1	1	2
1-3 yrs.	1	1	0	2	2
3-5 yrs.	2	0	1	1	2
5-10 yrs.	3	0	1	2	3
>10 yrs.	0	0	0	0	0
22. Applying Statistical Process Control					
<1 yr.	1	2	1	2	3
1-3 yrs.	3	2	1	4	5
3-5 yrs.	0	0	0	0	0
5-10 yrs.	2	0	1	1	2
>10 yrs.	0	0	0	0	0
23. Business Process Improvement					
<1 yr.	2	1	2	1	3
1-3 yrs.	2	2	0	4	4
3-5 yrs.	0	1	0	1	1
5-10 yrs.	1	0	1	0	1
>10 yrs.	0	0	0	0	0
24. Employee involvement to improve quality					
<1 yr.	1	1	1	1	2
1-3 yrs.	3	2	1	4	5
3-5 yrs.	2	0	1	1	2
5-10 yrs.	1	0	0	1	1
>10 yrs.	0	0	0	0	0
25. Cultural change programme					
<1 yr.	1	0	1	0	1
1-3 yrs.	0	1	0	1	1
3-5 yrs.	1	1	1	1	2
5-10 yrs.	1	0	0	1	1
>10 yrs.	0	0	0	0	0
26. Establishing measures of quality progress					
<1 yr.	3	0	1	2	3
1-3 yrs.	1	2	1	2	3
3-5 yrs.	0	0	0	0	0
5-10 yrs.	1	0	1	0	1
>10 yrs.	0	0	0	0	0

Table 4: Contd.,

27. Customer satisfaction initiatives					
<1 yr.	2	1	1	2	3
1-3 yrs.	1	0	1	0	1
3-5 yrs.	2	0	0	2	2
5-10 yrs.	2	1	1	2	3
>10 yrs.	0	0	0	0	0
28. Developing strategies for total quality					
<1 yr.	1	0	1	0	1
1-3 yrs.	2	0	0	2	2
3-5 yrs.	2	1	1	2	3
5-10 yrs.	1	0	1	0	1
>10 yrs.	0	1	0	1	1
29. Supplier involvement programme					
<1 yr.	1	0	1	0	1
1-3 yrs.	0	0	0	0	0
3-5 yrs.	2	1	1	2	3
5-10 yrs.	2	1	1	2	3
>10 yrs.	0	0	0	0	0
<i>Which of the following best describe the company's strategic objectives?</i>					
30. Profitability	3	0	1	2	3
31. Flexibility	0	0	0	0	0
32. Quality	4	3	2	5	7
33. Market Share	1	0	1	0	1
34. Cost	1	0	0	1	1
35. Innovation	2	1	1	2	3
36. Charity	0	1	0	1	1
<i>Which of the following criteria most helped you to win orders?</i>					
37. Manufacturing or Service quality	4	3	3	4	7
38. Product or service reliability	3	0	1	2	3
39. Speed with which order can be fulfilled	0	0	0	0	0
40. On time delivery	0	1	1	0	1
41. Wide product or service range	1	0	0	1	1
42. Ability to manufacture or deliver customer specials	2	1	0	3	3
43. Price	1	0	0	1	1

The results shown in table 4 suggest that the adoption of quality initiatives in Omani companies is not well established with the majority (>60%) of companies in the pilot study not certified with a quality assurance system as yet. This is particularly so for private sector companies and service companies as shown in figures 3 and 4, respectively.

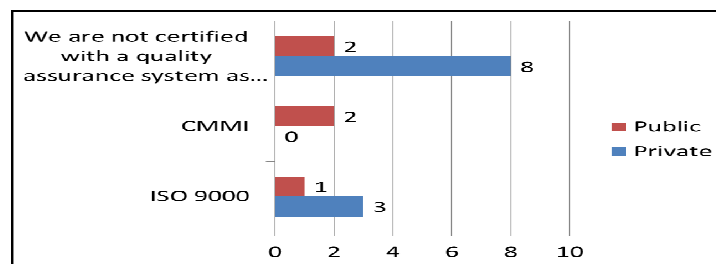


Figure 3: Adoption of Quality Assurance Systems by Public Sector Companies (n=5) and Private Sector Companies (n=11)

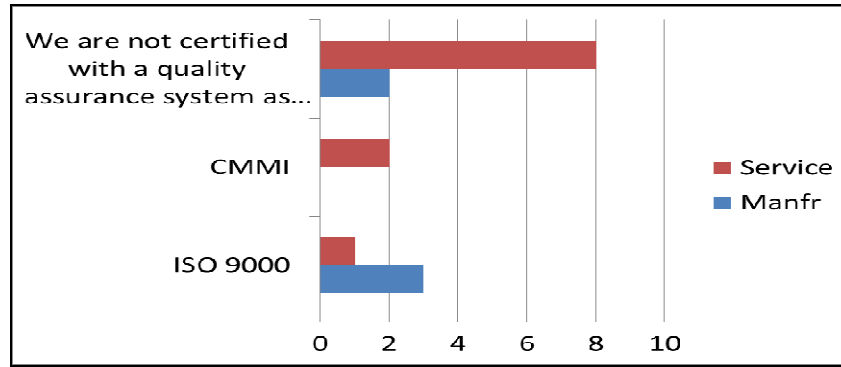


Figure 4: Adoption of Quality Assurance Systems by Manufacturing Companies (n=5) and Services Companies (n=11)

Very few of the quality initiatives considered (questions 21 to 29) were established more than 10 years ago and figure 5 compares the implementation of the initiatives listed in questions 11-20 with those from De Sousa et al (2005) who evaluated the use of quality initiatives in Portuguese Small and Medium Enterprises (SMEs). The results show that the most widely undertaken quality initiatives by Omani companies include:

- Setting up a Quality Department (69% of respondents)
- Employee involvement to improve quality (63% of respondents)
- Applying Statistical Process Control (56% of respondents)

However, these were nearly 20% lower on average than corresponding results for Portuguese SMEs way back in 2005, emphasising that quality initiatives in general at Omani companies are at an early stage of development.

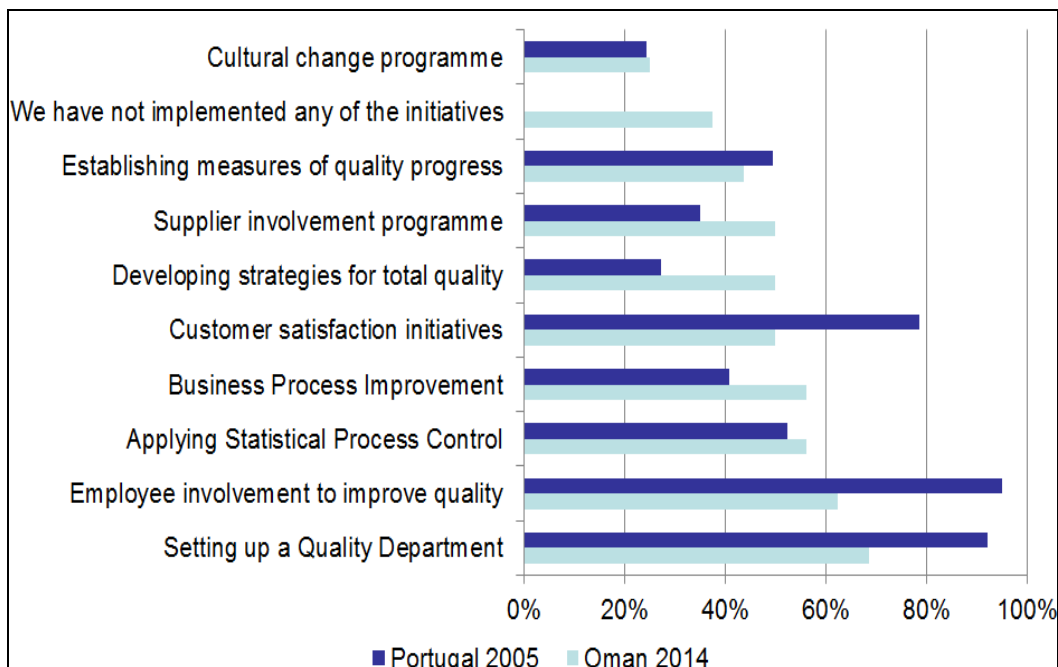


Figure 5: Comparison of the Level of Quality Initiatives Implemented by Portuguese and Omani Companies

4.3.2 Hayes and Wheelwright Model of the Strategic Role of Operations

Table 5: Results Related to the Hayes and Wheelwright Model of the Strategic Role of Operations

No.	Question	Mean	Std.
1	In our company, managing operations only involved strategic decisions occasionally.	3.13	1.09
2	We expected our operations simply to achieve whatever the other functions asked it to do, without involving operations in external benchmarking or strategic planning.	2.88	1.20
3	Improvements in our process technology were expected to come from our equipment suppliers	3.00	1.21
4	We did not see any need for operations management to plan more than a few months ahead.	2.69	1.35
5	We thought operations management’s plans should cover the financial year but no more.	3.31	0.95
6	We did not systematically build up our operations capability through in-house led improvements.	2.94	1.18
7	Our operations decisions were screened to be sure that they were consistent with business strategy	3.63	0.96
8	Operations management valued their operations strategy	3.63	0.96
9	Operations management systematically sought to identify long-term developments (e.g. in technology) which were key to our operations success.	3.38	1.20
10	We gained expertise in new practices and technologies to anticipate their potential and implications.	3.75	0.93
11	In our company operations was centrally involved in major marketing and engineering decisions.	3.44	1.09
12	Non-operations functions cooperated with operations to enable it to pursue the opportunities of new practices and technologies.	3.19	1.11
13	Our operations strategy was not derived from our business strategy. Rather, our business and operations strategies were developed jointly in a mutually supportive manner.	3.44	0.96
14	We had long-term programmes in place to acquire operations capabilities ahead of marketplace needs.	3.69	1.14
15	The strategic roles of all our functions were dominated by operations.	3.25	1.00
16	We were continually investing in in-house process improvements to benefit future products and services.	3.38	1.41
17	In our company, managing operations only involved strategic decisions occasionally.	3.13	1.09
	<i>To what extent do each of the following methods of Work Force Management apply to your organization's operations?</i>		
18	Worker is tightly controlled	3.07	1.33
19	Worker follows set procedures	3.93	0.27
20	Worker is permitted to choose from a number of alternative procedures	3.27	1.22
21	Worker is encouraged to develop innovative new ways of working	3.57	1.02

The results from Table 5 were inconclusive as there were no scores of 4 or more to show strong agreement for any of the 4 stages of the Hayes-Wheelwright model. The results are summarised in Figure 6 below where it can be seen that the respondents may have been biased in their answers as there is a slight preference for Stages 3 and 4 and this is inconsistent with the stage of quality initiatives within the companies as analysed in section 4.3.1. The only question with a score close to 4 was question 19 which would suggest a Stage 2 preference.

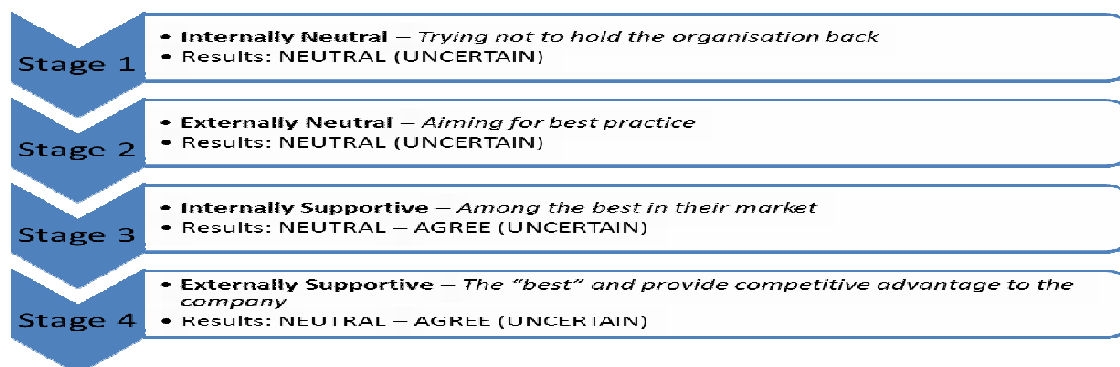


Figure 6: Summary of Hayes-Wheelwright Results

4.3.3 Quality Tools and Techniques

Table 6: Summary of Main Results Linked to Quality Tools and Techniques

Quality Tool	Oman Mean	Portugal Mean
1. Control charts/Statistical Process Control	3.80	
2. Scatter diagram	3.67	
3. Balance sheet or Plus/Delta Evaluation	3.67	
4. Surveys	3.60	3.05
5. Quality circles	3.60	
6. Benchmarking	3.53	
7. Conceptualisation checklist	3.47	
8. Process Flowchart	3.47	3.38
9. Questionnaires	3.40	3.17
10. Brainstorming	3.40	2.10
11. Check sheet	3.33	3.69
12. Group interview or focus group	3.33	2.08

Table 6 compares the implementation of the main quality tools and techniques considered by Omani companies in the pilot study with that found by De Sousa et al (2005) for Portuguese Small and Medium Enterprises (SMEs). The results show that operations management quality tools and techniques appear to be more widely used today by Omani companies than by Portuguese SMEs back in 2005 where De Sousa et al found that only 6 of the top 10 tools and techniques used by Portuguese SMEs had a mean value greater than 3.0.

In Table 7, the full range of results obtained for the Omani manufacturing and service companies represented in the pilot study are given. While there are differences between the two types of companies the sample considered is too small to make any real inferences. One would expect gap analysis to be more widely applicable in service companies and this is confirmed in Table 7 (see question 4). However, while one would expect FMEA and FMECA to be more widely used in manufacturing companies, this is not confirmed in table 7 (see question 5).

Table 7: Full Results Linked to Quality Tools and Techniques

	Quality Tool	Manufacturing Mean	Services Mean	Difference	Overall Mean
	<i>Please indicate your opinion about the level of use each tool has in your company:</i>				
1	Cause-and-effect Diagram	3.25	2.64	-23%	2.80
2	Balance sheet or Plus/Delta Evaluation	3.00	3.91	23%	3.67
3	Matrix data-analysis	2.50	3.18	21%	3.00
4	Gap analysis	2.75	3.45	20%	3.27
5	Failure Modes and Effects Analysis (FMEA) or Failure Mode, Effect and Criticality Analysis (FMECA)	2.75	3.36	18%	3.20
6	Check sheet	3.75	3.18	-18%	3.33
7	Systematic diagram or Tree diagram or Storyboard	2.75	3.30	17%	3.14
8	Poka-Yoke	3.00	2.60	-15%	2.71
9	Five Ss	3.25	2.82	-15%	2.93
10	Six-sigma	3.00	3.45	13%	3.33
11	Quality circles	3.25	3.73	13%	3.60
12	Histogram	2.75	2.45	-12%	2.53

13	Process Decision Program Chart	3.00	3.36	11%	3.27
14	Analytical Hierarchy Process	3.00	3.30	9%	3.21
15	Pareto chart or Pareto diagram	3.25	3.00	-8%	3.07
16	Conceptualisation checklist	3.25	3.55	8%	3.47
17	Process Flowchart	3.25	3.55	8%	3.47
18	Nominal Group Technique	2.75	3.00	8%	2.93
19	Matrix diagram (includes QFD)	2.50	2.73	8%	2.67
20	Relation diagram or Interrelationships diagraph	2.75	2.55	-8%	2.60
21	The KJ method® and the Affinity Diagram	2.75	2.55	-8%	2.60
22	Conjoint analysis	2.75	2.55	-8%	2.60
23	Fault tree analysis	3.00	3.18	6%	3.13
24	Positioning	3.25	3.09	-5%	3.13
25	Graphs	2.75	2.64	-4%	2.67
26	Questionnaires	3.50	3.36	-4%	3.40
27	Brainstorming	3.50	3.36	-4%	3.40
28	Surveys	3.50	3.64	4%	3.60
29	Group interview or focus group	3.25	3.36	3%	3.33
30	Scatter diagram	3.75	3.64	-3%	3.67
31	Quality Function Deployment (QFD)	3.00	2.91	-3%	2.93
32	Force field diagram	3.00	2.91	-3%	2.93
33	Table-type conceptualising	3.00	3.09	3%	3.07
34	Design of experiments	2.75	2.82	2%	2.80
35	Control charts/Statistical Process Control	3.75	3.82	2%	3.80
36	Benchmarking	3.50	3.55	1%	3.53
37	Network diagram/PERT or CPM chart	3.25	3.27	1%	3.27
38	3M	3.00	3.00	0%	3.00
39	Five whys	3.00	3.00	0%	3.00
40	Taguchi Methods or Robust design	3.00	3.00	0%	3.00

CONCLUSIONS

Insights gained into the research questions include:

Research Question 1: The results for the Hayes and Wheelwright model of the strategic role of operations were inconclusive. It was not possible to gauge which stage of the model, the Omani companies taking part in the study were located. This suggests the use of another instrument for future work such as that proposed by Jain et al (2013) or dropping the model from the final questionnaire.

Research Question 2: The most widely undertaken quality initiatives by Omani companies include:

- Setting up a Quality Department (69% of respondents)
- Employee involvement to improve quality (63% of respondents)
- Applying Statistical Process Control (56% of respondents)

However, these are nearly 20% lower on average than corresponding results for Portuguese SMEs in 2005. Additionally, >60% of the Omani companies have still not implemented a quality assurance system such as ISO9001 and this leads to the conclusion that the development of quality systems and initiatives within Omani companies is at an early stage of development.

Research Question 3: Operations management quality tools and techniques appear to be more widely used today by Omani companies than by Portuguese SMEs back in 2005 (D'Souza, 2005), with the most highly used including:

- Control charts/Statistical Process Control
- Scatter diagram
- Balance sheet or Plus/Delta Evaluation
- Surveys
- Quality circles
- Benchmarking

Research Question 4: The main difference between Omani private sector and public sector companies with respect to quality initiatives undertaken is that more of the public sector companies (~60%) are certified with a QA system whereas only ~30% of private sector companies are.

Research Question 5: The main difference between Omani manufacturing and service companies with respect to quality initiatives undertaken is that more of the manufacturing companies (~60%) are certified with a QA system whereas only ~30% of service companies are.

While there are many differences between Omani manufacturing and service companies with respect to quality tools and techniques preferred, these differences are difficult to interpret with the small sample used.

Overall, Omani companies do not appear to be advanced in the use of quality systems compared with European companies and therefore there is potential to improve this situation via the teaching of Operations Management courses such as that offered by the UoB MBA. The feedback secured suggests several ways that the design of the questionnaire can be improved. Further work is planned using a more robust questionnaire design and a larger sample of companies in order to overcome some of the limitations of the present research.

REFERENCES

1. Barnes, D. and Rowbotham, F. (2004), "Testing the four-stage model of the strategic role of operations in a UK context", *International Journal of Operations & Production Management*; 2004, Vol. 24 Issue 7, pp. 701-720
2. Bentley, Y; Shegunshi, A; and Scannell, M. (2010), "Evaluating the Impact of Distance Learning Support Systems on the Learning Experience of MBA Students in a Global Context", *Electronic Journal of e-Learning* Vol. 8, Issue 2 pp. 51 – 62
3. Chase, R. and Hayes, R. (1991), "Beefing up services firms", *Sloan Management Review*, pp. 15-26
4. Commission of the European Communities (2001) *Creating an Entrepreneurial Europe – the Activities of the European Union for Small and Medium-sized Enterprises (SMEs)* (Brussels: Commission of the European Communities).
5. Dangayach, G. and Deshmukh, S. (2003), "Evidence of manufacturing strategies in Indian industries: a survey", *International Journal of Production Economics*, Vol. 83, pp. 279-298.

6. De. SOUSA, S; ASPINWALL, E; SAMPAIO, P. & RODRIGUES, A. (2005), "Performance Measures and Quality Tools in Portuguese Small and Medium Enterprises: Survey Results", *Total Quality Management*, Vol. 16, No. 2, pp. 277 –307
7. Hum, S. (2000), "A Hayes-Wheelwright framework approach for strategic management of third party logistics services", *INTEGRATED MANUFACTURING SYSTEMS*; Vol. 11 (PART 2), pp. 132-137
8. Hum, S-H. and Leow, L-H. (1996), "Strategic manufacturing effectiveness: an empirical study based on the Hayes-Wheelwright framework", *International Journal of Operations & Production Management*, Vol. 16 Issue 4, pp. 4-18
9. Jain, B; Adil, G; Ananthakumar, U. (2013) "An instrument to measure factors of strategic manufacturing effectiveness based on Hayes and Wheelwright's model", *Journal of Manufacturing Technology Management*. 2013, Vol. 24 Issue 6, pp.812-829 Oxford Business Group (2014). "The Report: Oman 2014".
10. Rowbotham, F; and Barnes, D. (2004) "A questionnaire operationalising Hayes and Wheelwright's four-stage concept", *Journal of Manufacturing Technology Management*. (*Journal of Manufacturing Technology Management*, Vol. 15(7), pp.651-661
11. Slack, N; Chambers, S; and Johnston, R. (2010), "Operations Management" 6th Edition, Financial Times Prentice Hall
12. Turnitin (n.d.), "Reduce Plagiarism", http://turnitin.com/en_us/features/originalitycheck, accessed 23/03/2014
13. Wheelwright, S; and Hayes, R., (1985), "Competing through manufacturing", *Harvard Business Review*. Jan/Feb1985, Vol. 63 Issue 1, p99-109
14. Wild, R. (1971), "The techniques of production management", Holt, Reinhart and Winston, London.

