# CHAPTER 5

# RESULTS AND FINDINGS

*Research is the process of going up alleys to see if they are blind.*
***Marston Bates***

## 5.1 INTRODUCTION

The statistical analysis or empirical part of this study was aimed at providing data that could be used to satisfy the primary research objective described in Chapter 1:

*To develop a reliable holistic diagnostic assessment tool for measuring the project management culture, as an operational culture, in organisations.*
('Reliable' in this instance refers to the tool's ability to measure what it is supposed to measure and to diagnose an organisation in terms of its project management culture).

The empirical process started with the verification, by project management experts, of the project management culture framework and descriptive elements developed by Du Plessis (2001). This verification was done in support of the answer to the following research question (see Chapter 2):

*What should a supportive organisational culture for optimal project success consist of? Thus, what are the components / elements of a project management culture?*

## 5.2 RESULTS AND FINDINGS

The empirical part of this study with the statistical results and findings are divided into and described in three parts. These parts match the research

process (see Figure 4.2: Research design and process) as set out in Chapter 4:

- *verification* of the project management model and descriptive elements by project management experts;
- project management culture *tool development* (scale development); and
- *testing* the 'Project Management Culture Assessment Tool' (PMCAT) for Organisation A (assumed to have a supportive project management culture) and Organisation B (assumed not to have a supportive project management culture).

### 5.2.1 Verification of the project management model and descriptive elements by experts

Lawshe's (1975) content validity technique was applied to the dimensions and associated descriptive elements of a project management culture as identified by Du Plessis (2001. The results are shown in Tables 5.1 and 5.2. Table 5.1 shows the industry information on the expert sample group. Table 5.2 shows the results on the content validity of the project management culture dimensions and associated descriptive elements as perceived by project management experts.

**Table 5.1: Industry information on the project management expert sample group** (N= 52)

| | | | | |
|---|---|---|---|---|
| **Type of industry** | 1. Service (e.g. Banking, Education, Government) | | | 24 |
| | 2. Technical (e.g. Engineering/Manufacturing) | | | 28 |
| **Type of projects** | a. Technical ('hard-side' e.g. production, manufacturing) | | | 22 |
| | b. Non-Technical ('soft-side' e.g. processes, service delivery) | | | 30 |
| **Years of project work experience** | 5-10 yrs<br>6 | 11-15 yrs<br>17 | 16-20 yrs<br>19 | 21 +yrs<br>10 |
| **Qualification** | Bachelor's degree<br>4 | Honour's degree<br>18 | Master's degree<br>24 | Doctoral degree<br>6 |

The respondents represented both the technical ('hard side') and non-technical ('soft side') of projects. A valid assumption can be made about the balanced representation of technical (54%) and non-technical (46%) industries regarding their viewpoints on the validity of the project management culture dimension model and the descriptive elements. The respondents are all well-qualified: more than 50% have master's or doctoral degrees and more than 80% have in excess of ten years of project experience. One can conclude that they are experts and hence their views are regarded as relevant.

The findings set out in Table 5.2 (overleaf) show that the project environment might not be regarded as such an important dimension in relation to the other three dimensions (project process, people in projects, and project systems and structure). This finding was to be expected, because attention to a holistic view is often neglected in project management, due to a more internal focus on the operational project environment. However, the results from the descriptive elements under the project environment dimension reveals respondents' acceptance of almost all the elements. Thus project environment still seems relevant as a dimension in the model and is not excluded.

## Table 5.2: Content validity of project management culture dimensions and associated descriptive elements as perceived by project management experts

| DIMENSIONS and descriptive elements of a project management culture | N= Total respondents (52)<br>$n_e$ = Number of respondents<br>CVR= $\frac{ne-N/2}{}$<br><br>CVR= Content validity<br>CVR >50% or 0.50 acceptable | |
|---|---|---|
| **What is the relevance of the following dimensions and elements with regard to contributing towards a project management culture that leads to project success:** | **ne<br>Scale 4-5** | **CVR** |
| A. Process (the manner in which the project is designed, planned, and executed and controlled-monitored). | 52 | 1.0 |
| B. People (project stakeholders). | 44 | 0.85 |
| C. Structure and systems (project methodology). | 32 | 0.62 |
| D. Environment (internal and external). | 20 | ***0.38*** |
| A. The Project process | | |
| 1. The project process should be focussed on **results and delivering** unique outcomes. | 41 | 0.79 |
| **2.** The project process must be **clearly visualised and described**. | 36 | 0.60 |
| 3. **Discipline** regarding time, cost and quality is necessary. | 44 | 0.85 |
| 4. **Control** should be 'tight' to ensure cost deliverables. | 36 | 0.69 |
| **5.** **Control** should be 'loose' to ensure flexibility and innovation. | 6 | ***0.12*** |
| 6. **Control** is necessary to monitor progress and take necessary action. | 45 | 0.87 |
| 7. **Learning and continuous improvement** should be part of projects. | 36 | 0.69 |
| 8. Understanding and satisfying **customer needs** are necessary. | 44 | 0.85 |
| **9.** **Successes** should be determined and built into the **learning process.** | 40 | 0.79 |
| 10. **Failures** should be determined and built into the **learning process.** | 42 | 0.81 |
| 11. **Communication** should be continuous. | 43 | 0.83 |
| 12. Planned **communication sessions** should be conducted to give and obtain feedback. | 34 | 0.65 |
| 13. Understanding and applying the **project life cycle** will contribute towards success. | 22 | 0.42 |
| 14. The '**work breakdown structure**' should be used to **select** people for the project team. | 19 | ***0.37*** |

**Table 5.2: Content validity of project management culture dimensions and associated descriptive elements as perceived by project management experts** (continued)

| **B. People in projects** | **N= Total respondents<br>$n_e$ = Number of respondents<br>CVR= $\frac{ne-N/2}{N/2}$** | |
|---|---|---|
| | **$n_e$** | **CVR** |
| 1. Project success relies on sound **interpersonal relationships** | 44 | 0.85 |
| 2. Stakeholder **commitment** is necessary throughout the project life cycle | 41 | 0.79 |
| 3. People in projects should understand the **interdependence** between them | 38 | 0.73 |
| 4. Everyone involved in the project should be **disciplined** to deliver according to plan | 43 | 0.83 |
| 5. Projects have a **risk propensity** and need people who can take risks without being careless | 36 | 0.69 |
| 6. Every member in the project life cycle should have **clear goals and responsibilities** | 48 | 0.92 |
| 7. **Power and authority** have to be managed | 28 | 0.54 |
| 8. Tolerance for **conflict** is necessary | 42 | 0.81 |
| 9. **Interpersonal conflict** should be managed before it becomes destructive | 41 | 0.79 |
| 10. An affinity to **learning** is necessary during projects | 23 | ***0.44*** |
| 11. Everyone involved in the project must be **results' oriented** | 34 | 0.65 |
| 12. There must be **open communication** at all times | 48 | 0.92 |
| 13. People must be able to **respond quickly** to project demands | 29 | 0.56 |
| 14. Everyone in the project must understand their **role and responsibility** | 43 | 0.83 |
| **15. Teamwork** is important | 50 | 0.96 |
| 16. **Trust** amongst project stakeholders is important | 43 | 0.83 |
| 17. Managing **stress** is necessary | 31 | 0.60 |
| 18. Team member **credibility** is important | 28 | 0.54 |
| **19.** People in projects must **understand** the **importance of the project** and how they affect it | 48 | 0.92 |
| **20. The project manager** should have **credibility** amongst stakeholders | 45 | 0.87 |
| 21. **Project leadership** should be focused on creating a competent team to realise project goals | 45 | 0.87 |
| 22. Keeping **focus on the project goal** is vital | 46 | 0.88 |
| 23. People working on projects must be **technically competent** | 30 | 0.58 |
| 24. People working on projects must have sound **interpersonal skills** | 33 | 0.63 |
| **25. Competent people** should be recruited for the project | 43 | 0.83 |
| 26. Team members are carefully **selected** for each project | 33 | 0.63 |

**Table 5.2: Content validity of project management culture dimensions and associated descriptive elements as perceived by project management experts** (d)

| **C. Project structure and systems** | **N= Total respondents<br>$n_e$ = Number of respondents<br>CVR= $\frac{ne-N/2}{N/2}$** | |
|---|---|---|
| | **$n_e$** | **CVR** |
| 1. **Teamwork** is an essential structure for project success. | 52 | 1.0 |
| 2. The utilisation of the **organisational structure** should support project work. | 34 | 0.65 |
| **3. Team** members should be allowed to participate in the development of the project plan. | 35 | 0.67 |
| **4. Middle- management involvement** in the initial stages of the project should be ensured. | 38 | 0.73 |
| 5. **Interdependence** amongst project stakeholders is important. | 32 | 0.62 |
| 6. Project activities should be i**ntegrated** with the strategic priorities of the organisation. | 38 | 0.73 |
| 7. The project goal should be fully **integrated** with the strategic objectives of the organisation. | 33 | 0.63 |
| 8. **Networking structures** play a vital role in project success. | 43 | 0.83 |
| 9. **Flexibility** is necessary with regard to structure to ensure optimisation of resources. | 42 | 0.81 |
| 10. Delivery of unique project outcomes needs a sound **customer orientation.** | 45 | 0.87 |
| 11. The project's future lies in developing **clear goals.** | 46 | 0.88 |
| 12. Understanding and utilising **project methodology** and tools are important. | 52 | 1.0 |
| **13. The project plan** has to be developed with clear milestones. | 44 | 0.85 |
| **14.** The utilisation of **project management techniques is** essential. | 33 | 0.63 |
| 15. **Specifications** have to be developed for each project. | 37 | 0.71 |
| **D. Project environment** | | |
| 1. Management provides **sufficient resources** for the project. | 44 | 0.85 |
| 2. Organisational **practices and systems** should enable the project to deliver according to plan. | 39 | 0.75 |
| 3. **Top management support** for the project is essential. | 36 | 0.69 |
| 4. **Politics and power** should be sorted out or managed before the project commences. | 27 | 0.52 |
| 5. Projects **create change** and thus create uncertainty which has to be managed. | 38 | 0.73 |
| 6. The customer and external stakeholders' expectations **should be understood.** | 46 | 0.88 |
| 7. **Rewards and recognition** should be agreed when goals are set and aligned with organisation policy. | 27 | 0.52 |
| 8. **Rewards and recognition** should foster positive performance and motivation. | 40 | 0.77 |
| 9. **External changes** should be frequently monitored. | 32 | 0.62 |
| 10. Projects implemented in the same **environment influence** each other. | 24 | ***0.46*** |
| 11. The project environment encourages **innovation and creativity.** | 27 | 0.52 |

Sixty-three (63) out of the sixty-seven (67), thus 94%, descriptive elements included in the validity assessment questionnaire of a project management culture (see Table 5.2) have a content validity ratio of higher than 0.50. This shows that the theoretical construct of the project management culture framework and descriptive elements are viewed as valid and thus acceptable and can be used in an assessment tool. These responses answered the following research question: *What should a supportive organisational culture for optimal project success consist of? Thus, what are the components/elements of a project management culture?*

### 5.2.2 Project management culture tool development (scale development)

The valid descriptive elements derived from the analysis above were used to compile a list of 135 items (variables), which were included in a survey questionnaire (see Addendum B) that was sent out to project managers and team members (as described in Chapter 4 and in Table 5.3).

The biographical information on the sample group is set out in Table 5.3. It is clear from the biographical information that the sample group is well educated and experienced in the field of project management across a broad spectrum of industrial sectors. This also shows that the sample groups' perceptions represented a total industry perspective across various cultural groupings (especially relevant in the South African context).

The results and findings on the development of the project management assessment tool are reported sequentially (as the scale was developed), using the stages described by DeVellis (1991) in Chapter 2 (Literature study) and Chapter 4 (Research method).

**Table 5.3: Biographical information on the sample group of project managers and project members** (N=236)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age (years)** | **≤ 25** | **26-30** | **31-35** | **36-40** | **41-45** | **46-50** | **51-55** | **55 +** | | | |
| | 1 | 54 | 72 | 43 | 35 | 20 | 5 | 6 | | | |
| **Gender** | Male = 193 | | | | Female= 43 | | | | | | |
| **Economic sector** | **Primary sector** | **Secondary sector** | **Tertiary sector** | | **Government services** | **Other** | | | | | |
| | 18 | 93 | 90 | | 28 | 7 | | | | | |
| **Qualification** | **Std 10** | **Post-school Diploma/certificate** | **Bachelor's degree** | **Honours degree** | **Master's degree** | **Doctoral degree** | | | | | |
| | 0 | 33 | 85 | 68 | 47 | 5 | | | | | |
| **Work history (n of years)** | **< 6 mo.** | **6 mo -2 yrs** | **2-5 yrs** | **5-10 yrs** | **10-15 yrs** | **15-20 yrs** | **20-25 yrs** | **Over 25 yrs** | | | |
| | 1 | 5 | 35 | 66 | 58 | 42 | 12 | 17 | | | |
| **Marital status** | **Single** | **Married** | **Divorced** | **Widow/widower** | **Co-habitating** | | | | | | |
| | 61 | 164 | 10 | 0 | 1 | | | | | | |
| **Home language** | **Afrikaans** | **English** | **isiXhosa** | **thiVenda** | **isiZulu** | **isiNdebele** | **Sepedi** | **XiTsonga** | **Setswana** | **Seswati** | **Other** |
| | 111 | 78 | 8 | 2 | 11 | 1 | 4 | 1 | 2 | 2 | 14 Italian, Portuguese, Polish,"Indian" German, Dutch, French. |
| **Years as project team member** (mean) | 7.5 | | | | | | | | | | |
| **Years as project manager** (mean) | 5.8 | | | | | | | | | | |

*5.2.2.1 Item analysis*

The initial 135 items (see Addendum B) compiled from the descriptive elements in Table 5.2 were divided into a theoretical construct, based on the four-dimension model developed by Du Plessis (2001), namely:

- Project process;
- People in projects;
- Project systems and structure, and
- Project environment (internal and external).

Each of the four theoretical constructs was subjected to item analysis, using SAS (1997). Table 5.4 shows the number of items within the four-dimension theoretical construct. Tables 5.5 to 5.8 show the specific item analysis per theoretical construct. Table 5.9 shows the descriptive statistics of the respective four theoretical dimensions. Items with a total item correlation of $\leq$ 0.32 were eliminated as per rationale described in Chapter 3.

**Table 5.4: Number of items within the four-dimension theoretical construct**

| 1<br>**Project process** | 2<br>**People in projects** | 3<br>**Project systems and structure** | 4<br>**Project environment** |
|---|---|---|---|
| 40 | 29 | 48 | 18 |
| N of respondents = 236 | | | |

**Table 5.5: Item analysis per 'project process' construct - dimension 1**

| Item. No. | Scale item | Item mean | Item var. | Item-scale correlation | N per item |
|---|---|---|---|---|---|
| *7* | *1-1* | *3.271* | *1.003* | ***.11*** | *236* |
| 10 | 1-2 | 3.191 | 1.044 | .44 | 236 |
| 19 | 1-3 | 3.466 | 1.020 | .53 | 236 |
| 20 | 1-4 | 3.792 | 1.224 | .39 | 236 |
| 23 | 1-5 | 3.475 | 0.809 | .64 | 236 |
| 24 | 1-6 | 3.339 | 0.927 | .58 | 236 |
| *25* | *1-7* | *3.746* | *0.935* | ***.21*** | *236* |
| 28 | 1-8 | 3.566 | 1.182 | .65 | 236 |
| 29 | 1-9 | 3.979 | 0.758 | .65 | 236 |
| 32 | 1-10 | 3.254 | 1.181 | .70 | 236 |
| 33 | 1-11 | 3.144 | 0.920 | .66 | 236 |
| 37 | 1-12 | 3.195 | 1.038 | .63 | 236 |
| 39 | 1-13 | 3.889 | 0.566 | .52 | 236 |
| 40 | 1-14 | 3.508 | 1.123 | .64 | 236 |
| *42* | *1-15* | *3.568* | *0.881* | ***.27*** | *236* |
| 44 | 1-16 | 3.370 | 0.957 | .66 | 236 |
| 47 | 1-17 | 3.742 | 0.878 | .66 | 236 |
| 52 | 1-18 | 3.797 | 0.730 | .61 | 236 |
| 56 | 1-19 | 3.958 | 0.524 | .55 | 236 |
| 59 | 1-20 | 2.903 | 1.088 | .50 | 236 |
| 61 | 1-21 | 3.458 | 0.723 | .44 | 236 |
| 64 | 1-22 | 2.869 | 1.055 | .56 | 236 |
| 66 | 1-23 | 4.038 | 0.782 | .55 | 236 |
| 69 | 1-24 | 2.818 | 1.268 | .61 | 236 |
| 71 | 1-25 | 3.856 | 0.810 | .67 | 236 |
| 81 | 1-26 | 4.055 | 0.400 | .47 | 236 |
| 82 | 1-27 | 3.826 | 0.754 | .65 | 236 |
| 84 | 1-28 | 3.665 | 0.841 | .61 | 236 |
| 87 | 1-29 | 3.229 | 1.015 | .73 | 236 |
| 95 | 1-30 | 3.924 | 0.579 | .66 | 236 |
| *98* | *1-31* | *3.047* | *1.290* | ***.30*** | *236* |
| 100 | 1-32 | 3.890 | 0.734 | .66 | 236 |
| *103* | *1-33* | *2.686* | *1.419* | ***.32*** | *236* |
| 106 | 1-34 | 3.203 | 0.840 | .59 | 236 |
| 108 | 1-35 | 3.627 | 0.802 | .65 | 236 |
| 119 | 1-36 | 3.331 | 0.908 | .73 | 236 |
| 120 | 1-37 | 3.771 | 0.939 | .67 | 236 |
| 123 | 1-38 | 3.805 | 0.826 | .57 | 236 |
| 129 | 1-39 | 3.492 | 0.767 | .50 | 236 |
| 136 | 1-40 | 3.775 | 0.776 | .55 | 236 |

Five items (in bold) have a total item correlation of $\leq$ 0.32 and were eliminated from the item pool, resulting in 35 remaining items which were subjected to factor analysis.

**Table 5.6: Item analysis per 'people in project' construct - dimension 2**

| Item. No. | Scale item | Item mean | Item var. | Item-scale correlation | N per item |
|---|---|---|---|---|---|
| 4 | 2-1 | 3.890 | 0.564 | .49 | 236 |
| *5* | *2-2* | *3.746* | *1.130* | ***.32*** | *236* |
| 6 | 2-3 | 3.678 | 0.744 | .53 | 236 |
| *8* | *2-4* | *3.258* | *1.361* | ***.31*** | *236* |
| 15 | 2-5 | 3.525 | 0.953 | .70 | 236 |
| 16 | 2-6 | 3.250 | 0.984 | .59 | 236 |
| 18 | 2-7 | 4.229 | 0.490 | .41 | 236 |
| 26 | 2-8 | 3.492 | 1.013 | .54 | 236 |
| 27 | 2-9 | 2.686 | 1.029 | .46 | 236 |
| 34 | 2-10 | 3.225 | 0.759 | .57 | 236 |
| 48 | 2-11 | 3.496 | 1.114 | .63 | 236 |
| 63 | 2-12 | 4.144 | 0.801 | .55 | 236 |
| 67 | 2-13 | 3.403 | 0.935 | .64 | 236 |
| 72 | 2-14 | 3.720 | 0.862 | .60 | 236 |
| *74* | *2-15* | *3.661* | *0.521* | ***.32*** | *236* |
| 75 | 2-16 | 3.742 | 0.700 | .70 | 236 |
| *77* | *2-17* | *3.555* | *0.747* | ***.29*** | *236* |
| 86 | 2-18 | 3.847 | 0.655 | .70 | 236 |
| *89* | *2-19* | *3.771* | *0.617* | ***.28*** | *236* |
| 96 | 2-20 | 3.547 | 1.027 | .63 | 236 |
| 104 | 2-21 | 3.585 | 0.751 | .78 | 236 |
| 110 | 2-22 | 3.691 | 0.942 | .71 | 236 |
| *116* | *2-23* | *3.508* | *0.970* | ***.32*** | *236* |
| 122 | 2-24 | 3.962 | 0.706 | .72 | 236 |
| *125* | *2-25* | *3.377* | *1.065* | ***.19*** | *236* |
| 127 | 2-26 | 3.576 | 0.634 | .55 | 236 |
| 132 | 2-27 | 3.220 | 0.850 | .68 | 236 |
| *137* | *2-28* | *2.814* | *0.931* | ***-.00*** | *236* |
| 139 | 2-29 | 3.419 | 0.837 | .66 | 236 |

Eight items had a total item correlation of $\leq$ 0.32 and were eliminated from the item pool, resulting in 21 remaining items which were subjected to factor analysis.

**Table 5.7: Item analysis per 'project systems and structure' construct – dimension 3**

| Item. No. | Scale item | Item mean | Item var. | Item-scale correlation | N per Item |
|---|---|---|---|---|---|
| 11 | 3-1 | 3.974 | 0.587 | .46 | 236 |
| 12 | 3-2 | 2.345 | 0.856 | .03 | 236 |
| 13 | 3-3 | 1.928 | 0.584 | -.06 | 236 |
| 30 | 3-4 | 3.814 | 0.804 | .29 | 236 |
| 31 | 3-5 | 3.708 | 0.936 | .57 | 236 |
| 35 | 3-6 | 3.657 | 0.734 | .61 | 236 |
| 38 | 3-7 | 3.470 | 1.139 | .52 | 236 |
| 41 | 3-8 | 2.932 | 1.148 | .31 | 236 |
| 43 | 3-9 | 3.127 | 1.162 | .46 | 236 |
| 49 | 3-10 | 4.453 | 0.544 | .55 | 236 |
| 51 | 3-11 | 4.051 | 0.701 | .34 | 236 |
| 55 | 3-12 | 4.042 | 0.786 | .32 | 236 |
| 58 | 3-13 | 3.648 | 0.897 | .31 | 236 |
| 62 | 3-14 | 3.742 | 0.658 | .55 | 236 |
| 65 | 3-15 | 3.644 | 0.916 | .61 | 236 |
| 70 | 3-16 | 3.089 | 0.878 | .49 | 236 |
| 73 | 3-17 | 3.381 | 0.685 | .29 | 236 |
| 76 | 3-18 | 3.496 | 0.936 | .66 | 236 |
| 83 | 3-19 | 4.055 | 0.544 | .28 | 236 |
| 85 | 3-20 | 3.555 | 0.976 | .62 | 236 |
| 88 | 3-21 | 3.102 | 1.193 | .63 | 236 |
| 90 | 3-22 | 4.068 | 0.495 | .48 | 236 |
| 91 | 3-23 | 3.373 | 0.836 | .31 | 236 |
| 92 | 3-24 | 3.415 | 1.031 | .37 | 236 |
| 93 | 3-25 | 3.754 | 0.889 | .50 | 236 |
| 94 | 3-26 | 4.131 | 0.546 | .46 | 236 |
| 97 | 3-27 | 3.487 | 0.911 | .63 | 236 |
| 99 | 3-28 | 3.767 | 0.882 | .34 | 236 |
| 101 | 3-29 | 3.936 | 0.848 | .58 | 236 |
| 102 | 3-30 | 3.055 | 1.128 | .56 | 236 |
| 105 | 3-31 | 4.076 | 0.799 | .34 | 236 |
| 107 | 3-32 | 3.572 | 0.796 | .63 | 236 |
| 109 | 3-33 | 3.068 | 0.978 | .19 | 236 |
| 111 | 3-34 | 3.178 | 1.214 | .59 | 236 |
| 112 | 3-35 | 3.504 | 1.114 | .25 | 236 |
| 113 | 3-36 | 3.742 | 0.870 | .47 | 236 |
| 114 | 3-37 | 4.021 | 0.589 | .21 | 236 |
| 115 | 3-38 | 3.852 | 0.669 | .67 | 236 |
| 118 | 3-39 | 3.428 | 0.804 | .46 | 236 |
| 121 | 3-40 | 3.691 | 1.027 | .63 | 236 |
| 124 | 3-41 | 2.941 | 1.183 | .41 | 236 |
| 130 | 3-42 | 2.792 | 0.868 | -.14 | 236 |
| 131 | 3-43 | 3.606 | 0.824 | .53 | 236 |
| 133 | 3-44 | 4.216 | 0.483 | .50 | 236 |
| 134 | 3-45 | 3.640 | 0.824 | .59 | 236 |
| 138 | 3-46 | 3.767 | 0.814 | .55 | 236 |
| 140 | 3-47 | 3.301 | 0.829 | .49 | 236 |
| 141 | 3-48 | 3.593 | 1.326 | .44 | 236 |

Thirteen items had a total item correlation of ≤ 0.32 and were eliminated from the item pool, resulting in 35 remaining items which were be subjected to factor analysis.

**Table 5.8: Item analysis per 'project environment' construct - dimension 4**

| Item. No. | Scale item | Item mean | Item var. | Item-scale correlation | N per Item |
|---|---|---|---|---|---|
| 9 | 4-1 | 3.373 | 0.971 | .48 | 236 |
| 14 | 4-2 | 3.657 | 0.954 | .37 | 236 |
| 17 | 4-3 | 3.699 | 0.693 | .55 | 236 |
| 21 | 4-4 | 4.199 | 0.719 | .35 | 236 |
| 22 | 4-5 | 4.157 | 0.624 | .37 | 236 |
| 36 | 4-6 | 3.318 | 1.047 | .36 | 236 |
| 45 | 4-7 | 3.483 | 0.809 | .55 | 236 |
| 46 | 4-8 | 3.936 | 0.593 | .65 | 236 |
| 50 | 4-9 | 4.055 | 0.639 | .60 | 236 |
| 53 | 4-10 | 3.719 | 0.508 | .53 | 236 |
| 54 | 4-11 | 3.331 | 1.103 | .58 | 236 |
| *57* | 4-12 | 3.322 | 0.587 | ***.19*** | 236 |
| *60* | 4-13 | 3.225 | 1.123 | ***.16*** | 236 |
| 68 | 4-14 | 3.487 | 0.733 | .62 | 236 |
| 117 | 4-15 | 3.623 | 0.735 | .62 | 236 |
| 126 | 4-16 | 2.814 | 0.948 | .40 | 236 |
| 128 | 4-17 | 3.470 | 0.953 | .67 | 236 |
| 135 | 4-18 | 3.669 | 0.899 | .61 | 236 |

Two items had a total item correlation of ≤ 0.32 and were eliminated from the item pool, resulting in 16 remaining items which were subjected to factor analysis.

**Table 5.9: Descriptive statistics per project management culture dimension construct/scale** (N=236)

| **Dimension scale** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|
| N of items | 40 | 29 | 48 | 18 |
| Mean score | 140.470 | 103.017 | 170.161 | 61.182 |
| Variance | 433.995 | 200.406 | 390.425 | 57.259 |
| Std. dev. | 20.833 | 14.156 | 19.759 | 7.567 |
| Skew (Sk) | -0.117 | -0.309 | -0.206 | -0.430 |
| Kurtosis (Ku) | -0.513 | -0.321 | -0.087 | 0.588 |
| Cronbach Alpha | 0.940 | 0.908 | 0.913 | 0.802 |

Nunnally (1978) recommends a minimum level of 0.70 for a Cronbach alpha coefficient. Therefore the overall reliability of the items per dimension was

highly acceptable, with Cronbach alpha coefficients of 0.940, 0.908, 0.913 and 0.802 respectively (see Table 5.9).

**Table 5.10: Scale inter-correlations between dimensions**

| | 1 | 2 | 3 | 4 (Dimensions) |
|---|---|---|---|---|
| 1 | 1.000 | 0.863 | 0.902 | 0.800 |
| 2 | 0.863 | 1.000 | 0.891 | 0.782 |
| 3 | 0.902 | 0.891 | 1.000 | 0.825 |
| 4 | 0.800 | 0.782 | 0.825 | 1.000 |

The item inter-correlation (as indicated in Table 5.10) was high, which is expected of a construct that is supposed to be highly interdependent and systemic in nature.

To summarise the results from the item analysis the following items, with a total item correlation of $\leq$ 0.32 (see Tables 5.5 to 5.8) using Pearson's correlation technique were eliminated from the project management culture model within the four dimension theoretical construct:

- Project process construct

Five (5) of the initial 40 items: V7, V25, VV103, V42 and V98, leaving 35 items.

- People in projects

Eight (8) of the initial 29 items: V74, V77, V125, V137, V5, V8, V89, V116, leaving 21 items.

- Project structure and systems

Thirteen (13) of the initial 48 items: V41, V55, V58, V73, V76, V114, V109, V130, V30, V51, V83, V12, V13, leaving 35 items.

- Project environment

Two (2) of the initial 18 items: V57 and V60, leaving 16 items.

The remaining items under each project management culture dimension/construct (see Tables 5.5 to 5.8) were further subjected to Exploratory Factor Analysis (EFA) as reported in the following section on factor analysis.

### *5.2.2.2 Factor analysis*

Exploratory factor analysis (EFA) with oblique rotation, direct oblimin, within the BMDP Statistical Software (1993) provided the results (see Tables 5.11to 5.24) obtained from the 236 responses for each of the four project management culture dimensions in the theoretical construct. A scree test was used to determine the number of factors with Kaiser's eigenvalues higher than 1.0 for each theoretical construct. The factors were chosen based on the results of the scree test, their percentage variance contribution as well as their Cronbach alpha coefficient. They were further subjected to factor analysis. The rotated analysis results were used to analyse the factor loadings. Variables with factor loadings of $\leq$ 0.5 were eliminated to improve reliability, as was described in the rationale for the methodology in Chapter 3, without compromising the theoretical framework of the holistic project management culture construct.

#### *(a) Factor analysis on the 'project process' construct*

The scree test on 'project process' revealed nine factors with an eigenvalue of > 1.0 as set out in Table 5.11.

**Table 5.11: Eigenvalues and % variance for 'project process'**

| Factor | Eigenvalue | % Variance | Total variance |
|---|---|---|---|
| 1 | 13.2073 | 30.83 | 0.3083 |
| 2 | 2.53073 | 5.01 | 0.3584 |
| 3 | 2.12373 | 3.76 | 0.3960 |
| 4 | 1.59323 | 3.10 | 0.4270 |
| 5 | 1.50602 | 2.66 | 0.4536 |
| 6 | 1.34660 | 2.49 | 0.4785 |
| 7 | 1.20911 | 2.40 | 0.5025 |
| 8 | 1.10459 | 2.05 | 0.5230 |
| 9 | 1.04589 | 1.61 | 0.5391 |
| Cronbach Alpha | 0.9422 | | |

It is clear from the percentage variance representation of the factors in Table 5.11 that a one-factor or possibly a three-factor scale is evident. Hence, further factor analyses on three-factors and one-factor were done to develop the scale instrument.

The three-factor analysis (see Table 5.12) on the project process construct shows that the one-factor is more reliable with a Cronbach alpha coefficient of 0.915 and representing 29.87%. The second factor has only three items with acceptable factor loadings and is therefore not suitable for a scale, although the Cronbach alpha coefficient is higher than 0.70. This explains the preference for one-factor (see Table 5.13) with a Cronbach alpha coefficient of 0.9483 for all the variables. The eight items (see Table 5.13 in bold) with factor loadings of $\leq$ 0.50 were eliminated, resulting in 27 remaining items with a factor loading above 0.500. These 27 items were again factor-analysed (see Table 5.14). The Cronbach alpha for all the variables in Table 5.14 was 0.9301 and the total variance in data space was 34.15%. Even though some of the items in Table 5.14 had a factor loading lower than 0.500, they were not eliminated, because otherwise the theoretical construct would have been negatively affected.

**Table 5.12: Sorted rotated factor loadings on 35 items in three factors in 'the project process' construct** (N = 236)

| Items (n =35) | Factor 1 loadings | Factor 2 loadings | Factor 3 loadings |
|---|---|---|---|
| 47 | **0.788** | 0.00 | 0.00 |
| 108 | **0.767** | 0.00 | 0.00 |
| 84 | **0.760** | 0.00 | 0.00 |
| 66 | **0.737** | 0.00 | 0.00 |
| 71 | **0.733** | 0.00 | -0.299 |
| 82 | **0.723** | 0.00 | 0.00 |
| 123 | **0.695** | 0.00 | 0.00 |
| 100 | **0.667** | 0.00 | 0.00 |
| 29 | **0.665** | 0.00 | 0.00 |
| 120 | **0.626** | 0.00 | 0.00 |
| 39 | **0.555** | 0.00 | 0.00 |
| 24 | **0.535** | 0.00 | 0.00 |
| 95 | **0.513** | 0.00 | 0.00 |
| 19 | **0.509** | 0.00 | 0.393 |
| 136 | **0.500** | 0.00 | 0.342 |
| 33 | 0.00 | **1.000** | 0.00 |
| 32 | 0.00 | **0.885** | 0.00 |
| 64 | 0.00 | **0.517** | 0.00 |
| 59 | 0.00 | 0.333 | 0.447 |
| 52 | 0.361 | 0.00 | 0.387 |
| 129 | 0.00 | 0.00 | 0.370 |
| 40 | 0.382 | 0.00 | 0.352 |
| 87 | 0.347 | 0.323 | 0.332 |
| 37 | 0.310 | 0.288 | 0.276 |
| 106 | 0.268 | 0.302 | 0.00 |
| 81 | 0.464 | 0.00 | 0.00 |
| 44 | 0.314 | 0.317 | 0.00 |
| 10 | 0.00 | 0.00 | 0.00 |
| 28 | 0.470 | 0.00 | 0.00 |
| 69 | 0.453 | 0.00 | 0.00 |
| 56 | 0.494 | 0.00 | 0.00 |
| 23 | 0.440 | 0.264 | 0.00 |
| 119 | 0.312 | 0.00 | 0.00 |
| 20 | 0.00 | 0.00 | 0.00 |
| 61 | 0.267 | 0.00 | 0.00 |
| Cronbach Alpha | 0.9152 | 0.7667 | 0.3612 |
| % variance | 29.87 | 5.66 | 4.07 |

**Table 5.13: Sorted rotated factor loadings after Exploratory Factor Analysis on 35 items on one-factor for 'the project process' construct** (N = 236)

| **Items (n =35)** | **Factor 1 loadings** |
|---|---|
| 19 | 0.717 |
| 10 | 0.698 |
| 120 | 0.694 |
| 71 | 0.692 |
| 108 | 0.687 |
| 47 | 0.686 |
| 100 | 0.677 |
| 32 | 0.675 |
| 95 | 0.674 |
| 82 | 0.673 |
| 39 | 0.662 |
| 84 | 0.649 |
| 28 | 0.642 |
| 59 | 0.629 |
| 37 | 0.622 |
| 40 | 0.616 |
| 20 | 0.615 |
| 61 | 0.613 |
| 69 | 0.588 |
| 24 | 0.587 |
| 123 | 0.577 |
| 52 | 0.571 |
| 106 | 0.570 |
| 66 | 0.567 |
| 81 | 0.558 |
| 136 | 0.555 |
| 64 | 0.553 |
| ***29*** | ***0.498*** |
| ***119*** | ***0.484*** |
| ***56*** | ***0.462*** |
| ***129*** | ***0.458*** |
| ***33*** | ***0.427*** |
| ***44*** | ***0.410*** |
| ***87*** | ***0.372*** |
| ***23*** | ***0.328*** |
| Cronbach's Alpha | 0.9483 |
| % variance | 35.35 |

**Table 5.14: Sorted rotated factor loadings for 27 items on one factor for 'the project process' construct** (N = 236)

| Items (n =27) | Factor 1 Loadings |
|---|---|
| 108 | 0.727 |
| 71 | 0.714 |
| 47 | 0.710 |
| 82 | 0.699 |
| 120 | 0.692 |
| 100 | 0.684 |
| 84 | 0.674 |
| 95 | 0.664 |
| 28 | 0.635 |
| 32 | 0.626 |
| 24 | 0.612 |
| 123 | 0.605 |
| 37 | 0.602 |
| 66 | 0.600 |
| 69 | 0.589 |
| 40 | 0.588 |
| 106 | 0.559 |
| 136 | 0.551 |
| 52 | 0.540 |
| 64 | 0.524 |
| 39 | 0.524 |
| 81 | 0.471 |
| 19 | 0.444 |
| 59 | 0.392 |
| 61 | 0.389 |
| 10 | 0.337 |
| 20 | 0.309 |
| Cronbach's Alpha | 0.9301 |
| % Variance | 34.15 |

*(b) Factor analysis of the 'People in Projects' construct*

The scree test on the 'people in projects' construct revealed eight factors with an eigenvalue of > 1.0 (see Table 5.15).

The % variance representation of the factors in Table 5.15 indicates the possibility of a one-factor or a two-factor scale, because the other six factors have a much smaller percentage than the other two. Therefore, further factor

analyses on two-factors and one-factor were done to develop the scale instrument.

The two-factor analysis (see Table 5.16) on the 'people in projects' construct shows that the one factor is more reliable with a Cronbach alpha coefficient of 0.8856 and represented 31.21%. The second factor had a Cronbach alpha coefficient of 0.6705, which is lower than the acceptable level of 0.70 and contributes only 3.46 %. This explains the preference for one factor (see Tables 5.17 and 5.18) with a final Cronbach alpha coefficient of 0.9204 for all the variables, representing 36.70%. Nine items (in bold) with factor loadings of $\leq$ 0.50 were eliminated from the first round of factor analysis on one factor (see Table 5.17), resulting in 20 remaining items, with a factor loading above 0.500.

**Table 5.15: Eigenvalues and % variance for 'people in projects' construct**

| Factor | Eigenvalue | % Variance | Total variance |
|---|---|---|---|
| 1 | 9.60730 | 19.04 | 0.1904 |
| 2 | 1.77170 | 14.95 | 0.3399 |
| 3 | 1.65083 | 3.59 | 0.3758 |
| 4 | 1.45362 | 2.92 | 0.4050 |
| 5 | 1.32183 | 2.86 | 0.4336 |
| 6 | 1.16738 | 2.78 | 0.4614 |
| 7 | 1.07282 | 2.88 | 0.4902 |
| 8 | 1.02518 | 2.54 | 0.5156 |
| Cronbach Alpha | 0.9147 | | |

**Table 5.16: Sorted rotated factor loadings on 29 items in two factors in 'the people in projects' construct** (N = 236)

| Items (n =35) | Factor 1 loadings | Factor 2 loadings |
|---|---|---|
| 122 | **0.800** | 0.00 |
| 75 | **0.797** | 0.00 |
| 86 | **0.768** | 0.00 |
| 18 | **0.738** | 0.00 |
| 96 | **0.667** | 0.00 |
| 72 | **0.657** | 0.00 |
| 67 | **0.616** | 0.00 |
| 127 | **0.609** | 0.00 |
| 104 | **0.574** | 0.306 |
| 110 | **0.547** | 0.00 |
| 15 | 0.311 | **0.568** |
| 16 | 0.00 | **0.559** |
| 34 | 0.00 | 0.477 |
| 63 | 0.484 | 0.425 |
| 6 | 0.00 | 0.425 |
| 132 | 0.395 | 0.419 |
| 139 | 0.401 | 0.419 |
| 4 | 0.00 | 0.345 |
| 27 | 0.00 | 0.299 |
| 48 | 0.424 | 0.287 |
| 26 | 0.364 | 0.00 |
| vv5 | 0.00 | 0.00 |
| vv125 | 0.00 | 0.00 |
| vv8 | 0.00 | 0.00 |
| 77 | 0.407 | 0.00 |
| vv137 | 0.00 | 0.00 |
| 89 | 0.432 | 0.00 |
| 116 | 0.00 | 0.00 |
| 74 | 0.345 | 0.00 |
| Cronbach Alpha | 0.8856 | 0.6705 |
| % Variance | 31.21 | 3.46 |

**Table 5.17: Sorted rotated factor loadings after EFA on 29 items on one factor for 'the people in project' construct** (N = 236)

| **Items (n =29)** | **Factor 1 loadings** |
|---|---|
| 104 | 0.773 |
| 75 | 0.755 |
| 86 | 0.752 |
| 110 | 0.740 |
| 15 | 0.701 |
| 139 | 0.669 |
| 132 | 0.649 |
| 67 | 0.636 |
| 96 | 0.614 |
| 48 | 0.610 |
| 72 | 0.602 |
| 127 | 0.541 |
| 26 | 0.537 |
| 16 | 0.532 |
| 34 | 0.508 |
| 63 | 0.506 |
| 6 | 0.504 |
| 4 | 0.502 |
| 27 | 0.501 |
| 18 | 0.500 |
| **77** | **0.366** |
| **26** | **0.346** |
| **74** | **0.222** |
| **89** | **0.216** |
| **vv5** | **0.00** |
| **vv125** | **0.00** |
| **vv8** | **0.00** |
| **vv137** | **0.00** |
| **116** | **0.00** |
| Cronbach Alpha | 0.9103 |
| % variance | 34.60 |

**Table 5.18: Sorted rotated factor loadings after EFA on 20 items on one factor for 'the people in project' construct** (N = 236)

| Items (n =20) | Factor 1 Loadings |
|---|---|
| 104 | 0.783 |
| 75 | 0.735 |
| 86 | 0.713 |
| 110 | 0.712 |
| 15 | 0.681 |
| 139 | 0.666 |
| 132 | 0.659 |
| 67 | 0.639 |
| 96 | 0.625 |
| 48 | 0.610 |
| 72 | 0.602 |
| 127 | 0.541 |
| 26 | 0.537 |
| 16 | 0.532 |
| 34 | 0.508 |
| 63 | 0.501 |
| 6 | 0.497 |
| 4 | 0.453 |
| 27 | 0.426 |
| 18 | 0.397 |
| Cronbach Alpha | 0.9204 |
| % variance | 36.70 |

*(c) Factor analysis of the 'Project systems and structures' construct*

The scree test on project structure and systems revealed thirteen (13) factors with an eigenvalue of > 1.0 (see Table 5.19).

**Table 5.19: Eigenvalues and % variance for 'project structure and systems' construct** (N = 236)

| Factor | Eigenvalue | % Variance | Total variance |
|---|---|---|---|
| 1 | 11.6439 | 22.76 | 0.2276 |
| 2 | 3.16464 | 5.28 | 0.2804 |
| 3 | 2.38550 | 3.93 | 0.3197 |
| 4 | 1.96263 | 2.73 | 0.3470 |
| 5 | 1.75428 | 2.46 | 0.3716 |
| 6 | 1.62200 | 2.27 | 0.3943 |
| 7 | 1.45790 | 2.00 | 0.4143 |
| 8 | 1.34549 | 1.59 | 0.4302 |
| 9 | 1.30360 | 1.63 | 0.4465 |
| 10 | 1.24076 | 1.61 | 0.4626 |
| 1 | 1.18668 | 1.30 | 0.4756 |
| 12 | 1.09765 | 1.25 | 0.4881 |
| 13 | 1.06476 | 0.96 | 0.4977 |
| Cronbach's Alpha | 0.9158 | | |

It is clear from Table 5.19 that a two-factor or three-factor scale is possible. Therefore, further factor analyses on two-factors and three-factors were done to develop the scale instrument. Table 5.20 shows the results of the three-factor scale. Although the Cronbach's alphas were higher than 0.70, one of the scales only had four items with a factor loading higher than 0.500, which did not justify a separate scale. Thus a two-factor scale was more suitable.

Five (5) items with factor loadings of $\leq$0.500 were eliminated from the two factor project systems and structure factor scale (see Table 5.21), resulting in 30 remaining items with a factor loading above 0.500. These 30 items were subjected to further factor analysis and the results are shown in Table 5.22. Each of the factors had 15 items with a Cronbach alpha above 0.70 that were included in the final assessment tool.

**Table 5.20: Sorted rotated factor loadings on 35 items in three factors in the 'projects systems and structure' construct** (N = 236)

| Items (n =35) | Factor 1 loadings | Factor 2 loadings | Factor 3 loading |
|---|---|---|---|
| 107 | **0.718** | 0.00 | 0.00 |
| 31 | **0.645** | 0.00 | 0.00 |
| 38 | **0.643** | 0.00 | 0.00 |
| 102 | **0.637** | 0.00 | 0.00 |
| 43 | **0.661** | 0.00 | 0.00 |
| 111 | **0.593** | 0.00 | 0.00 |
| 99 | **0.562** | 0.00 | 0.00 |
| 90 | **0.522** | 0.00 | 0.00 |
| 101 | **0.509** | 0.00 | 0.00 |
| 85 | 0.00 | **0.609** | 0.00 |
| vv124 | 0.00 | **0.556** | 0.00 |
| vv76 | 0.00 | **0.503** | 0.00 |
| 105 | 0.00 | 0.00 | **0.652** |
| 51 | 0.00 | -0.264 | **0.607** |
| 133 | 0.00 | 0.00 | **0.535** |
| 49 | 0.00 | 0.00 | **0.532** |
| 114 | 0.00 | 0.00 | **0.520** |
| 94 | 0.00 | 0.00 | **0.520** |
| 138 | 0.00 | 0.00 | **0.518** |
| 113 | 0.00 | 0.00 | **0.517** |
| vv92 | 0.00 | 0.00 | **0.517** |
| 65 | 0.00 | **0.536** | 0.262 |
| 35 | 0.00 | 0.390 | 0.00 |
| 88 | 0.00 | 0.374 | 0.00 |
| 70 | 0.00 | 0.368 | 0.00 |
| 115 | 0.439 | 0.279 | 0.00 |
| 11 | 0.00 | 0.414 | 0.00 |
| 141 | 0.257 | 0.00 | 0.00 |
| 97 | 0.423 | -0.266 | 0.00 |
| 109 | 0.00 | 0.00 | 0.00 |
| 134 | 0.00 | 0.485 | 0.00 |
| 62 | 0.312 | 0.391 | 0.00 |
| 118 | 0.354 | 0.00 | 0.00 |
| 131 | 0.00 | 0.316 | 0.00 |
| 121 | 0.407 | 0.434 | 0.00 |
| Cronbach alpha | 0.8453 | 0.7892 | 0.7378 |
| % Variance | 23.37 | 5.42 | 4.13 |

**Table 5.21: Sorted rotated factor loadings on 35 items in two factors in the 'projects systems and structure' construct** (N = 236)

| Items (n =35) | Factor 1 loadings | Factor 2 loadings |
|---|---|---|
| 85 | 0.760 | 0.000 |
| 134 | 0.633 | 0.000 |
| 121 | 0.630 | 0.000 |
| vv124 | 0.612 | -0.268 |
| 65 | 0.586 | 0.000 |
| 102 | 0.568 | 0.000 |
| 62 | 0.555 | 0.000 |
| vv92 | 0.544 | 0.000 |
| 35 | 0.541 | 0.000 |
| 90 | 0.538 | 0.000 |
| 70 | 0.531 | 0.313 |
| 11 | 0.518 | 0.000 |
| 115 | 0.509 | 0.000 |
| 113 | 0.506 | 0.000 |
| 111 | 0.501 | 0.000 |
| vv76 | 0.000 | 0.585 |
| 141 | 0.000 | 0.577 |
| 43 | 0.000 | 0.564 |
| 99 | 0.000 | 0.553 |
| 31 | 0.000 | 0.515 |
| 51 | 0.304 | 0.507 |
| 38 | 0.361 | 0.506 |
| 101 | 0.000 | 0.503 |
| 107 | 0.000 | 0.503 |
| 49 | 0.000 | 0.502 |
| 94 | 0.000 | 0.501 |
| 109 | 0.293 | 0.501 |
| 133 | 0.500 | 0.312 |
| 138 | 0.500 | 0.286 |
| 105 | 0.000 | 0.500 |
| **97** | ***0.000*** | ***0.331*** |
| **88** | ***0.000*** | ***0.313*** |
| **118** | ***0.000*** | ***0.220*** |
| **131** | ***0.266*** | ***0.284*** |
| **140** | ***0.000*** | ***0.255*** |
| Cronbach's Alpha | 0.8417 | 0.7564 |
| % Variance | 23.26 | 5.26 |

**Table 5.22: Sorted rotated factor loadings on 30 items in two factors in the 'project systems and structure' construct**
(N = 236)

| Items (n =30) | Factor 1 loadings | Factor 2 loadings |
|---|---|---|
| 85 | **0.773** | 0.000 |
| 134 | **0.663** | 0.000 |
| 121 | **0.643** | 0.000 |
| 65 | **0.631** | 0.000 |
| 35 | **0.607** | 0.000 |
| 62 | **0.592** | 0.000 |
| 115 | 0.000 | **0.572** |
| vv124 | **0.567** | -0.296 |
| 70 | **0.534** | 0.000 |
| 11 | **0.525** | 0.000 |
| 90 | **0.518** | 0.000 |
| 43 | 0.000 | **0.562** |
| 99 | 0.000 | **0.524** |
| 31 | 0.279 | **0.506** |
| 38 | 0.251 | **0.505** |
| 51 | 0.000 | **0.505** |
| 107 | 0.254 | **0.504** |
| 101 | 0.360 | **0.504** |
| 109 | 0.000 | **0.385** |
| vv76 | 0.000 | **0.381** |
| 49 | 0.342 | **0.390** |
| 102 | 0.301 | **0.406** |
| 94 | 0.233 | **0.403** |
| 105 | 0.000 | **0.393** |
| 111 | **0.472** | 0.000 |
| 138 | **0.385** | 0.000 |
| 113 | **0.393** | 0.000 |
| 141 | 0.206 | **0.450** |
| 133 | **0.417** | 0.000 |
| vv92 | **0.318** | 0.000 |
| Cronbach's Alpha | 0.8951 | 0.7883 |
| % Variance | 24.37 | 5.68 |

*(d) Factor analysis of the 'Project environment' construct*

The scree test on the 'project environment' construct revealed five (5) factors with an eigenvalue of > 1.0 (see Table 5.23).

**Table 5.23: Eigenvalues and % variance of the 'project environment' construct**

| Factor | Eigenvalue | % variance | Total variance |
|---|---|---|---|
| 1<br>2<br>3<br>4<br>5 | 4.68827<br>1.69508<br>1.46004<br>1.22566<br>1.07056 | 10.08<br>12.39<br>14.12<br>5.85<br>3.24 | 0.1008<br>0.2247<br>0.3659<br>0.4244<br>0.4568 |
| Cronbach Alpha | 0.8104 | | |

It is clear from Table 5.23 that a one-factor or two-factor scale was possible. Therefore, further factor analyses on one factor and two factors were done to develop the scale instrument.

Items with factor loading of $\leq$ 0.500 were eliminated from the project systems and structure factor scale. Thus four items (see Table 5.25 indicated in bold) were eliminated, resulting in 12 remaining items with a factor loading above 0.500.

These 12 remaining items were again subjected to factor analysis (see Table 5.26) with an acceptable Cronbach alpha of 0.8361 and a percentage variance of 30.89.

**Table 5.24: : Sorted rotated factor loadings on 16 items in two factors in the 'project environment' construct** (N = 236)

| Items (n =16) | Factor 1 loadings | Factor 2 loadings |
|---|---|---|
| 46 | 0.681 | 0.000 |
| 128 | 0.651 | 0.000 |
| 135 | 0.640 | 0.000 |
| 68 | 0.625 | 0.000 |
| 50 | 0.601 | 0.000 |
| 117 | 0.594 | 0.000 |
| 17 | 0.561 | 0.000 |
| 45 | 0.511 | 0.000 |
| 21 | 0.000 | 0.997 |
| 22 | 0.000 | 0.514 |
| 14 | 0.000 | 0.254 |
| 53 | 0.468 | 0.000 |
| 54 | 0.469 | 0.000 |
| 122 | 0.412 | 0.000 |
| 36 | 0.361 | 0.000 |
| 9 | 0.430 | 0.000 |
| Cronbach alpha | 0.8354 | 0.6208 |
| % Variance | 10.21 | 21.16 |

**Table 5.25: Sorted rotated factor loadings on 16 items in one factor in the 'project environment' construct** (N = 236)

| Items (n =16) | Factor 1 loadings |
|---|---|
| 46 | 0.686 |
| 128 | 0.641 |
| 135 | 0.623 |
| 50 | 0.622 |
| 68 | 0.600 |
| 117 | 0.595 |
| 17 | 0.537 |
| 54 | 0.512 |
| 45 | 0.505 |
| 122 | 0.505 |
| 53 | 0.503 |
| 9 | 0.501 |
| **14** | ***0.344*** |
| **36** | ***0.304*** |
| **22** | ***0.262*** |
| **21** | ***0.000*** |
| Cronbach alpha | 0.8261 |
| % Variance | 25.01 |

**Table 5.26: Sorted rotated factor loadings on 12 items in one factor in the 'project environment' construct** (N = 236)

| Items (n =12) | Factor 1 loadings |
|---|---|
| 46 | 0.693 |
| 122 | 0.652 |
| 135 | 0.637 |
| 50 | 0.619 |
| 128 | 0.618 |
| 68 | 0.594 |
| 117 | 0.590 |
| 17 | 0.542 |
| 54 | 0.511 |
| 45 | 0.488 |
| 53 | 0.477 |
| 9 | 0.448 |
| Cronbach alpha | 0.8361 |
| % Variance | 30.89 |

The final result of the factor analyses was 89 items divided into five factors that represented the project management culture assessment tool (see Table 5.27).

**Table 5.27: Final factor scale for the project management culture assessment tool**

| Factor 1 Project process | Factor 2 People in projects | Factor 3 Project structure | Factor 4 Project systems | Factor 5 Project environment |
|---|---|---|---|---|
| 27 items | 20 items | 15 items | 15 items | 12 items |

Table 5.28 shows which items resort under which factor scale and make up the project management culture assessment tool (See Addendum B for item numbers and variable).

**Table 5.28: Final items per five-factor scale after item analysis and EFA on the project management culture model and construct**

| Project process 1 | | People in projects 2 | Project structure & systems | | Project environment 5 |
|---|---|---|---|---|---|
| | | | Structure 3 | Systems 4 | |
| 10 | 40 | 4 | 11 | 31 | 9 |
| 19 | 52 | 6 | 35 | 38 | 17 |
| 20 | 69 | 15 | 62 | 43 | 45 |
| 24 | 82 | 16 | 65 | 49 | 46 |
| 28 | 95 | 18 | 70 | 51 | 50 |
| 32 | 100 | 26 | 85 | vv76 | 53 |
| 37 | 106 | 27 | 90 | 94 | 54 |
| 39 | 108 | 34 | vv92 | 99 | 68 |
| 47 | 120 | 48 | 111 | 101 | 117 |
| 59 | 123 | 63 | 113 | 102 | 122 |
| 61 | 136 | 67 | 121 | 105 | 128 |
| 64 | | 72 | vv124 | 107 | 135 |
| 66 | | 75 | 133 | 109 | |
| 71 | | 86 | 134 | 115 | |
| 81 | | 96 | 138 | 141 | |
| 84 | | 104 | | | |
| | | 110 | | | |
| | | 127 | | | |
| | | 132 | | | |
| | | 139 | | | |
| **27 items** | | **20 items** | **15 items** | **15 items** | **12 items** |

**Total number of items = 89**

After the completion of the exploratory factor analyses and the elimination of items, a final item analysis was done on the 85 remaining items, out of the initial 135 items/variables, per factor root for each of the five-factor scales. The results of the final item analysis are shown in Table 5.29 to Table 5.35. All the items have a total item correlation of > 0.32, which indicates that the items in the final tool have a high validity.

**Table 5.29: Final item analysis on the 'project process' factor root**

| Scale item | Item mean | Item Var. | Item-scale correlation | N per Item |
|---|---|---|---|---|
| 1-1 | 3.466 | 1.020 | .50 | 236 |
| 1-2 | 3.566 | 1.182 | .66 | 235 |
| 1-3 | 3.195 | 1.038 | .63 | 236 |
| 1-4 | 4.038 | 0.782 | .60 | 236 |
| 1-5 | 3.856 | 0.810 | .70 | 236 |
| 1-6 | 3.792 | 1.224 | .39 | 236 |
| 1-7 | 3.665 | 0.841 | .65 | 236 |
| 1-8 | 3.627 | 0.802 | .70 | 236 |
| 1-9 | 3.458 | 0.723 | .44 | 236 |
| 1-10 | 2.869 | 1.055 | .56 | 236 |
| 1-11 | 3.805 | 0.826 | .60 | 236 |
| 1-12 | 3.339 | 0.927 | .62 | 236 |
| 1-13 | 3.203 | 0.840 | .59 | 236 |
| 1-14 | 3.191 | 1.044 | .41 | 236 |
| 1-15 | 3.254 | 1.181 | .68 | 236 |
| 1-16 | 2.903 | 1.088 | .47 | 236 |
| 1-17 | 3.889 | 0.566 | .53 | 235 |
| 1-18 | 3.742 | 0.878 | .69 | 236 |
| 1-19 | 4.055 | 0.400 | .48 | 236 |
| 1-20 | 3.924 | 0.579 | .68 | 236 |
| 1-21 | 3.508 | 1.123 | .63 | 236 |
| 1-22 | 3.797 | 0.730 | .59 | 236 |
| 1-23 | 2.818 | 1.268 | .62 | 236 |
| 1-24 | 3.826 | 0.754 | .68 | 236 |
| 1-25 | 3.890 | 0.734 | .68 | 236 |
| 1-26 | 3.771 | 0.939 | .69 | 236 |
| 1-27 | 3.775 | 0.776 | .57 | 236 |

**Table 5.30: Final Item analysis on the 'people' in projects factor root**

| Scale item | Item mean | Item var. | Item-scale correlation | N per Item |
|---|---|---|---|---|
| 2-1 | 3.890 | 0.564 | .47 | 236 |
| 2-2 | 3.525 | 0.953 | .71 | 236 |
| 2-3 | 3.403 | 0.935 | .65 | 236 |
| 2-4 | 3.847 | 0.655 | .71 | 236 |
| 2-5 | 3.419 | 0.837 | .69 | 236 |
| 2-6 | 3.250 | 0.984 | .59 | 236 |
| 2-7 | 3.742 | 0.700 | .71 | 236 |
| 2-8 | 3.220 | 0.850 | .68 | 236 |
| 2-9 | 3.496 | 1.114 | .66 | 236 |
| 2-10 | 3.492 | 1.013 | .60 | 236 |
| 2-11 | 3.678 | 0.744 | .54 | 236 |
| 2-12 | 3.225 | 0.759 | .56 | 236 |
| 2-13 | 3.585 | 0.751 | .78 | 236 |
| 2-14 | 4.229 | 0.490 | .41 | 236 |
| 2-15 | 2.686 | 1.029 | .51 | 236 |
| 2-16 | 3.720 | 0.862 | .63 | 236 |
| 2-17 | 4.144 | 0.801 | .53 | 236 |
| 2-18 | 3.547 | 1.027 | .64 | 236 |
| 2-19 | 3.691 | 0.942 | .73 | 236 |
| 2-20 | 3.576 | 0.634 | .55 | 236 |

**Table 5.31: Final item analysis on the 'structure' in projects factor root**

| Scale item | Item mean | Item var. | Item-scale correlation | N per Item |
|---|---|---|---|---|
| 3-1 | 3.657 | 0.734 | .63 | 236 |
| 3-2 | 4.216 | 0.483 | .49 | 236 |
| 3-3 | 3.640 | 0.824 | .65 | 236 |
| 3-4 | 3.974 | 0.587 | .55 | 235 |
| 3-5 | 3.742 | 0.658 | .61 | 236 |
| 3-6 | 3.644 | 0.916 | .66 | 236 |
| 3-7 | 3.089 | 0.878 | .58 | 236 |
| 3-8 | 3.555 | 0.976 | .74 | 236 |
| 3-9 | 4.068 | 0.495 | .54 | 236 |
| 3-10 | 3.691 | 1.027 | .67 | 236 |
| 3-11 | 2.941 | 1.183 | .56 | 236 |
| 3-12 | 3.496 | 0.936 | .32 | 236 |
| 3-13 | 3.852 | 0.669 | .65 | 236 |
| 3-14 | 3.178 | 1.214 | .59 | 236 |
| 3-15 | 3.415 | 1.031 | .45 | 236 |

**Table 5.32: Final item analysis on the 'systems' in projects factor root**

| Scale item | Item mean | Item var. | Item-scale correlation | N per Item |
|---|---|---|---|---|
| 4-1 | 3.742 | 0.870 | .48 | 236 |
| 4-2 | 3.593 | 1.326 | .46 | 236 |
| 4-3 | 3.470 | 1.139 | .61 | 236 |
| 4-4 | 3.767 | 0.882 | .53 | 236 |
| 4-5 | 3.055 | 1.128 | .57 | 236 |
| 4-6 | 3.572 | 0.796 | .63 | 236 |
| 4-7 | 3.068 | 0.978 | .38 | 236 |
| 4-8 | 3.708 | 0.936 | .64 | 236 |
| 4-9 | 3.127 | 1.162 | .61 | 236 |
| 4-10 | 4.051 | 0.701 | .48 | 236 |
| 4-11 | 4.076 | 0.799 | .43 | 236 |
| 4-12 | 3.936 | 0.848 | .63 | 236 |
| 4-13 | 4.453 | 0.544 | .59 | 236 |
| 4-14 | 4.131 | 0.546 | .52 | 236 |
| 4-15 | 3.767 | 0.814 | .53 | 236 |

**Table 5.33: Final item analysis on the 'environment in projects' factor root**

| Scale item | Item mean | Item var. | Item-scale correlation | N per Item |
|---|---|---|---|---|
| 5-1 | 3.331 | 1.103 | .57 | 236 |
| 5-2 | 3.487 | 0.733 | .64 | 236 |
| 5-3 | 3.470 | 0.953 | .68 | 236 |
| 5-4 | 3.699 | 0.693 | .60 | 236 |
| 5-5 | 3.669 | 0.899 | .68 | 236 |
| 5-6 | 3.623 | 0.735 | .62 | 236 |
| 5-7 | 3.373 | 0.971 | .53 | 236 |
| 5-8 | 3.936 | 0.593 | .69 | 236 |
| 5-9 | 4.055 | 0.639 | .65 | 235 |
| 5-10 | 3.719 | 0.508 | .54 | 235 |
| 5-11 | 3.483 | 0.809 | .56 | 236 |
| 5-12 | 3.962 | 0.706 | .67 | 236 |

**Table 5.34: Descriptive statistics of the final item analysis in the Five-factor scale**

| Scale: | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| N of Items | 27 | 20 | 15 | 15 | 12 |
| N of Examinees | 236 | 236 | 236 | 236 | 236 |
| Mean | 96.191 | 71.364 | 54.140 | 55.517 | 43.775 |
| Variance | 227.052 | 127.011 | 62.476 | 57.835 | 42.793 |
| Std. dev. | 15.068 | 11.270 | 7.904 | 7.605 | 6.542 |
| Skew | -0.144 | -0.267 | -0.119 | -0.632 | -0.346 |
| Kurtosis | -0.471 | -0.427 | -0.608 | 0.796 | 0.071 |
| Alpha | 0.928 | 0.915 | 0.855 | 0.822 | 0.853 |

**Table 5.35: Scale intercorrelations**

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1.000 | 0.881 | 0.815 | 0.809 | 0.830 |
| 2 | 0.881 | 1.000 | 0.872 | 0.687 | 0.859 |
| 3 | 0.815 | 0.872 | 1.000 | 0.574 | 0.833 |
| 4 | 0.809 | 0.687 | 0.574 | 1.000 | 0.665 |
| 5 | 0.830 | 0.859 | 0.833 | 0.665 | 1.000 |

The descriptive statistics in Table 5.34 show that the overall reliability of the items per dimension is highly acceptable, with Cronbach alpha coefficients of 0.928, 0.915, 0.855, 0.822 and 0.853 respectively, (higher than the acceptable minimum level of 0.70). The scale intercorrelation in Table 5.35 shows that the factors are still highly intercorrelated and this can be

expected from an interdisciplinary, holistic construct of factors that are systemic in nature.

### 5.2.3 Testing the 'Project Management Culture Assessment Tool' (PMCAT)

The project management assessment tool derived from the research process should be able to distinguish between different sample groups to be useful as a diagnostic instrument. A hypothesis can be postulated stating that the 'PMCAT' will show a significant level of acceptance ($p \leq 0.05$) if tested in an operational project environment, thus it will indicate with a statistical significance of $p \leq 0.05$ that an organisation has or does not have a project management culture.

Two sample groups (as described in Chapter 4) completed the PMCAT. The data obtained from the two sample groups are set out in Tables 5.36 and 5.37. The biographical data shows (see Table 5.36) that the two groups differ with regard to their experience as project team members and project managers. Organisation A was expected to be more successful and to have a project management culture in place, whereas Organisation B was expected not to have a project management culture in place.

The Mann Whitney non-parametric t-test was used to confirm or reject the said hypothesis, due to independent samples and small sample size. The Levene's F- value in Table 5.37 is the assumption that the variances of the two groups are equal (Morgan & Griego, 1998). However, if the Levene's F value is statistically significant, $p \leq 0{,}05$, then the variances are significantly different and the assumption of equal variances are violated which is the case in this study. The statistical significance shown in Table 5.37 for all the factors was $p \leq 0.001$ which indicates that there is a significant difference between the two groups. Therefore the project management culture assessment tool supports the hypothesis that the tool should be able to distinguish between independent sample groups.

**Table 5.36: Biographic data of the two sample groups - A and B**

| | Organisation A | Organisation B |
|---|---|---|
| Total sample N | 18 | 25 |
| **Biographical variable** | | |
| **Age (years)** | | |
| < 25 | 1 | 1 |
| 26 -30 | 3 | 2 |
| 31-35 | 3 | 10 |
| 36-40 | 4 | 8 |
| 41-45 | 4 | 1 |
| 46-50 | 1 | 1 |
| 51-55 | 1 | 2 |
| 55-60 | 1 | 0 |
| **Gender** | | |
| Male | 15 | 16 |
| Female | 3 | 9 |
| **Qualifications** | | |
| Secondary School | 0 | 0 |
| Matric | 2 | 5 |
| Post School | | |
| Certificate/Diploma | 9 | 12 |
| B- Degree | 7 | 4 |
| Honours Degree | 0 | 3 |
| Masters Degree | 0 | 1 |
| Doctoral | 0 | 0 |
| **Industry sector** | | |
| Manufacturing | 18 | 0 |
| Government | 0 | 25 |
| **Work history** | | |
| < 6 mo | 0 | 0 |
| 6mo -2 yrs | 1 | 1 |
| 2 -5 yrs | 1 | 6 |
| 5-10 yrs | 2 | 10 |
| 10-15 yrs | 5 | 3 |
| 15-20 yrs | 3 | 2 |
| over 20 yrs | 6 | 3 |
| **Marital status** | | |
| Single | 1 | 5 |
| Married | 16 | 15 |
| Divorced | 1 | 5 |
| **Home Language** | | |
| Afrikaans | 7 | 6 |
| English | 9 | 5 |
| isiXhosa | 1 | 6 |
| thiVenda | 0 | 0 |
| isiZulu | 0 | 4 |
| isiNdebele | 0 | 0 |
| Sepedi | 0 | 2 |
| xiTsonga | 1 | 0 |
| Setswana | 0 | 1 |
| Seswati | 0 | 1 |
| Other | 0 | 0 |
| **Years experience** (mean): | | |
| Project team member | 7.8 | 3.8 |
| Project manager | 4.7 | 1.7 |

**Table 5.37: Independent sample, Mann-Whitney t-test between two groups Organisation A and Organisation B**

N(A)=18 and N(B)= 25

| Variable | *Mean* | | *Std. Dev.* | | *F-Levene value* | *P-value* |
|---|---|---|---|---|---|---|
| | **A** | **B** | **A** | **B** | | |
| **Factor 1: Project process** | 102.944 | 73.1599 | 9.52 | 14.44 | 3.42 | 0.001 |
| **Factor 2: People in projects** | 75.666 | 50.239 | 8.26 | 9.65 | 2.02 | 0.001 |
| **Factor 3: Project structure** | 55.444 | 39.839 | 5.61 | 7.06 | 2.93 | 0.001 |
| **Factor 4: Project systems** | 56.888 | 42.879 | 4.81 | 7.57 | 4.21 | 0.001 |
| **Factor 5: Project environment** | 46.555 | 33.199 | 4.99 | 7.39 | 3.25 | 0.001 |

The data in Table 5.37 clearly shows that organisation A (with less respondents than organisation B) had a higher mean for all five factor scales than organisation B. Thus organisation A is perceived to be having a 'stronger' project management culture than organisation B. This also indicated that the PMCAT measures what it should measure, since organisation A was selected as the 'stronger' organisation in terms of project management application and experience. The statistical data comparing the two organisations with another and with the 100% profile of the PMCAT is best illustrated in a profile diagram (see Figure 5.1).

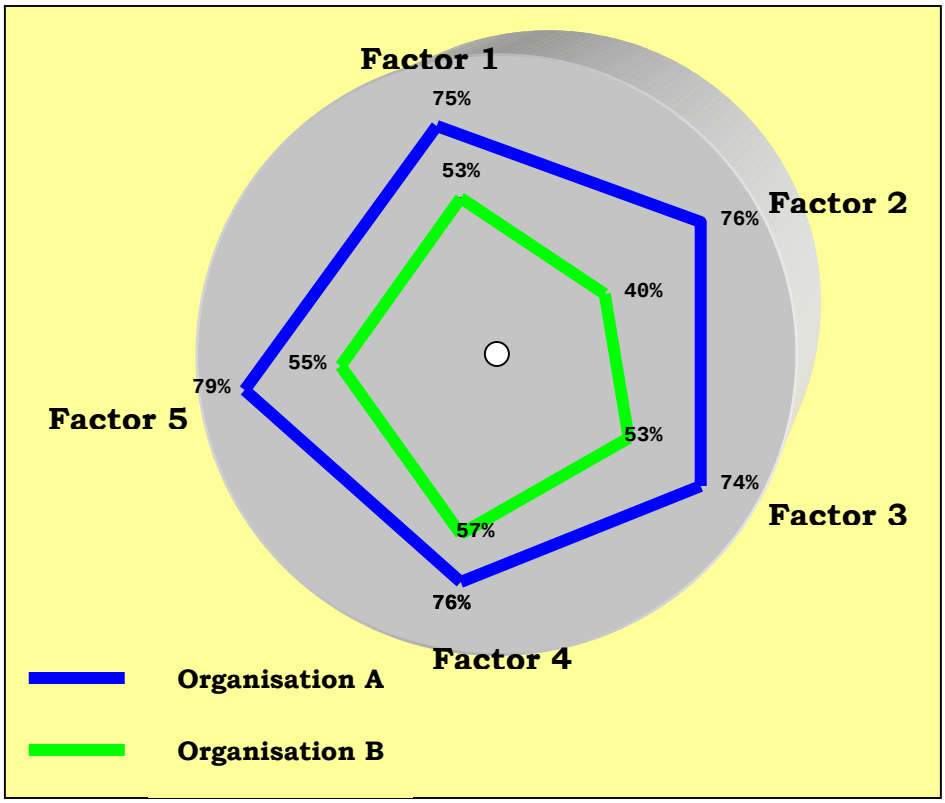


**Figure 5.1: Profile of two organisations compared with the PMCAT 100% profile**

## 5.3 CONCLUSION

It can be said that this research has achieved its primary objective, namely '*to develop a reliable holistic diagnostic assessment tool for measuring the project management culture, as operational culture, in organisations*'. As was stated in the introduction to this chapter "reliable" in this instance refers to its ability to measure what it is supposed to measure and to diagnose an organisation in terms of its project management culture. The empirical evidence in support of the primary objective of this study is shown in Table 5.1 to Table 5.37. The principles of 'good scientific research' as described in Chapter 3 and indicated in Table 3.1 ('high ethical standards applied,

adequate analysis and findings presented unambiguously') were applied during the implementation phase of this study as a project.

The rationale for the research methodology described in Chapter 3 and the research method discussed in Chapter 4 were also complied with during the empirical part of this study.