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The Influence of National Culture Dimensions on Agile Artifacts in the South African Software Development Context

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² **Abstract**— Culture influences how agile frameworks are implemented, and agility is said to be suitable in contexts where flexibility and spontaneity are emphasized. While past studies have investigated the influence of national culture on Agile implementations in Western and Eastern contexts, studies focusing on a South African software development context is limited. Furthermore, few studies have focused on the effect of cultural differences within software engineering in general. The purpose of this study is to describe how national culture influences Agile artifacts within the South African software development context. The study was interpretive and was executed using a qualitative, semi-structured interview research strategy directed at Agile practitioners in South African software development teams. The thematic analysis technique was used to analyze the data. Seven propositions have been formulated to highlight how national culture dimensions influence Agile artifacts.

Index Terms— Agile Software Development, National Culture, Agile Artifacts, South Africa.

I. INTRODUCTION

Agile frameworks are underpinned by values and principles which are described in the Agile Manifesto for successful software implementations [1]. The Agile values emphasize collaboration and interaction to mitigate issues which often hamper the success of software projects [2]. Since agility is like a mindset or culture, it is imperative to have an environment that characterizes and supports the Agile software development process [3]. This is particularly important given that culture plays a role in how Agile frameworks are utilized and implemented [4]. For instance, the Agile culture requires the active involvement of team members and is said to be suitable where there is a flat structure (low power distance). Moreover, flexibility and spontaneity are emphasized [5]. Cultures from Anglo-Saxon countries, where Agile methodologies originate from, and Nordic countries, are closest aligned to Agile values [6]. Since Agile values are based on Western culture, there is a need to investigate their suitability for contexts that demonstrate different values [7]. This is supported by recent concerns from Agile practitioners regarding

whether it was possible to implement Agile artifacts with all nationalities and cultures [8].

Zhao (2015) studied the impact of culture, namely Chinese and Swedish, on the implementation of Scrum, a type of Agile methodology. Their findings concluded that national culture influences Scrum implementations, in terms of how Scrum roles, ceremonies, and artifacts are utilized. Zhao (2015) proposed conducting their study in a different country context to China (Eastern culture) and Sweden (Western culture) to further explore how aspects of national culture might impact Agile implementations. This study has been conducted in response to this recommendation. Indeed, South Africa offers an interesting context of study, due to its heterogeneous cultural grouping [9]. While studies have been conducted to investigate the influence of national culture on Agile implementations in Western and Eastern country contexts, there is no research that explores the influence of national culture and the implementation of Agile methodologies in the South African software development context. Furthermore, few studies have focused on the effect of cultural differences within software engineering in general [10].

According to Hofstede's culture classification, South Africa is identified as having high power distance, individualism, masculinity, and indulgence as well as low uncertainty avoidance and long-term orientation [11]. For instance, South Africans enjoy clearly defined roles and therefore do not like to be called team members [12]. Moreover, South African culture is different to Western or Eastern culture in that it is less homogenous [13] and the introduction of different cultures in a team can be problematic for Agile implementations. Even though there is evidence in practice of Agile methods recently being incorporated in African countries, there is a lingering question about how its core values, with roots in western attitudes and behaviors, relates to non-western cultures [14].

In response to the above-mentioned research problems, the purpose of this study is to describe how national culture dimensions influence Agile implementations within the South African software development context. This paper specifically reports on the findings related to the influence on Agile

artifacts. The research question has been formulated as follows: How does national culture dimensions influence Agile artifacts within the South African software development context? This study contributes to Agile software development literature through seven propositions articulating the influence of various cultural dimensions on Agile artifacts in South African software development teams. The findings are also relevant to other non-South African teams that demonstrate similar cultural traits.

The paper is organized as follows. Following on from the introduction, a review of literature is presented in relation to the research problem regarding national culture suited for Agile software development. The conceptual framework employed for this study is then described, followed by an overview of the methodology employed for the study. The findings are then described and discussed considering the extent literature to articulate the research contributions. The paper is then concluded.

II. LITERATURE REVIEW

A. Defining Culture and National Culture

Culture is composed of traits and characters peculiar to a group of people which makes them unique from other societies [15]. These traits include language, dress code, music, work, arts, religion, dancing and more. It also entails social norms, taboos, and values [16]. Since culture is a broad term, in this research we will narrow the concept of culture to values and practices that people acquire by living in different countries i.e., national culture [17].

There are several frameworks used for studying national culture. Some examples include Hofstede (2013) [11] and Hampton-Turner (1990) [18]. National cultures are a segment of the “mental software” we acquired during the first ten years of our lives and hold most of our basic values [19]. This study focuses on the Hofstede and Globe national culture frameworks as data is available for South Africa pertaining to these frameworks. Moreover, other studies (e.g., Zhao (2015) [7]; Sutharshan (2013) [4], Palokangas (2013) [20]) have successfully employed these frameworks in the context of Agile software development. The frameworks are discussed in the Theoretical Framework section.

B. The South African Social Context

South Africa, which is also known as the “rainbow nation,” has a culture that is one of the most multifaceted and diverse in the world [21]. It consists of 60.1 million people of which 30.8 million (51.1%) are female and 29.4 million (48.9%) are male (<http://www.statssa.gov.za/>, 2021). There are four distinct population groups namely, Black African, Coloured, Indian/Asian, and White [22]. In Southern Africa, among the traditional Nguni people which includes the Zulu, Xhosa, Ndebele, and Swazi people there exists a common way of life known as ‘Ubuntu’ [23]. Ubuntu means humanity and the term can loosely translated as “I am because we are” [24]. The core values of Ubuntu are summarized as respect for the dignity of others, group solidarity, teamwork, service to others,

and the spirit of harmony and interdependence (i.e., ‘each one of us needs all of us’) [25]. The fifth dimension, the spirit of harmony and interdependence, was labelled as the spirit of Ubuntu. Wanasika et al. (2011) posit the philosophy of Ubuntu encompasses human existence and social relations. Wanasika et al. (2011) then argues, that while there are views of collectivism being associated with current relationships, Ubuntu is grounded in history and includes the present and future obligations to individuals as well [26]. Another example of the collectivism in Ubuntu is that there is no phrase or concept of “Agree to disagree,” therefore a consensus must be reached on mutual understanding and agreement regarding a matter through socialization [27], which is associated with modern society and the related practices embedded in education.

C. Agility and its Value System

Agile frameworks are based on values and principles defined in the Agile Manifesto. From a cultural point of view, Agile frameworks call for minimal hierarchy, and favor self-organization, equity, empowerment, commitment, responsibility, participation, learning and continuous improvement, consensus, respect, compromises, trust, honesty, openness, and communication [28].

According to the Manifesto, agility values individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a prescribed plan. The Agile Manifesto also formulates twelve principles that guide the nature of Agile frameworks [29].

D. Scrum and its Value System

Scrum is one of the frameworks that falls within the Agile umbrella. The Scrum framework provides the flexibility to control and manage requirements and the development process by allowing software to be developed in small chunks in multiple iterations [30]. The life cycle of the Scrum framework includes planning, staging, development, and release [31]. The Scrum values relate to Courage, Focus, Commitment, Respect and Openness and encourage management and team members to take responsibility instead of blame shifting [32]. Schwaber and Sutherland (2017) suggest that Scrum teams need to become proficient in living the Scrum values to successfully use Scrum [33]. The framework consists of three aspects namely roles, processes, and artifacts [34], and are briefly summarized in Table 1.

E. Influence of National culture on Agile implementations

Past studies have found that national culture can impact Scrum implementations. According to literature, Power distance influences Agile roles in relation to leadership qualities,

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TABLE I.
DESCRIPTION OF SCRUM ASPECTS

Scrum Aspects	Description
Artifacts – Product backlog	The product backlog is a prioritized list of tasks that contains the product requirements [42]. The purpose of the product backlog is to keep track of all work that must be done as well as bug fixes [21].
Artifacts – Sprint backlog	The sprint backlog contains a subset of requirements derived from the product backlog that can be completed during a sprint [42].
Artifacts – Burndown chart	The burndown chart shows a holistic view of how the project is progressing and allows for an assessment of the rate at which items are completed [32].
Artifacts – Task board	The task board is used to track the status of all tasks pertaining to user stories [21] [34].
Roles – Product Owner	The Product Owner is responsible for providing requirements and maintaining the product backlog [33].
Roles – Scrum Master	The Scrum Master is responsible for enacting the Scrum values and practices, and to remove impediments [34].
Roles – Scrum team members	Scrum team members are responsible for achieving the project goals. The characteristics of the Scrum team are: self-organizing; cross-functional; no titles for Developers; does not recognize sub-teams; and there may be individuals who have specialized skills, but the responsibility lies with the team [33].
Processes – Sprint	A Sprint that is an event time-boxed to a month or less, where a useable, and potentially a releasable product is created [33].
Processes – Sprint planning	At the beginning of a Sprint, a Sprint Planning meeting is held where the Product Owner will communicate which components, or features identified in the backlog, are to be prioritized into the next Sprint and which features can be developed in other Sprints [32].
Processes – Daily Scrum	The daily Scrum is a fifteen-minute time-boxed event held every day between the Scrum Master and the team members [33].
Processes – Sprint review	The sprint review is held at the end of sprint to inspect the increment (i.e., demonstration to Product Owner) and to adjust the product backlog if necessary [33].
Processes – Sprint retrospective	During the sprint retrospective, the team reviews its past processes and creates a plan to improve during the next Sprint [33].

responsibilities, and decision-making power [7]. For instance, Sutharshan and Maj (2011) found that in cultures with low power distance, employees are not afraid to challenge authority and leaders are not autocratic or paternalistic. Instead, a consultative style of decision-making and participative management style prevails [35]. In individualist countries, team members emphasize the importance of personal responsibility pertaining to the quality of tasks completed [7].

In relation to Scrum, teams with a higher uncertainty avoidance index demonstrate more rigorous planning practices, and use tried and tested tools instead of being open to risk-taking [10]. Uncertainty avoidance plays a role in certain software processes, such as requirements being specified upfront, test-first programming, and making early design decisions [10]. The use of burndown charts and limitations on sprint interruptions are also more prevalent in cultures with a high degree of uncertainty avoidance [7].

1 III. THEORETICAL FRAMEWORK

This study employed the Hofstede, GLOBE, and Schwartz project national culture dimensions to inform its theoretical

framework. Hanges and Dickson (2004) compared the national culture dimensions of Hofstede to the GLOBE project national culture dimensions, as well as the GLOBE study national culture dimensions to the Schwartz national culture dimensions [36]. Their findings indicate similarities between Hofstede's and GLOBE's power distance dimension. Hofstede's and GLOBE's uncertainty avoidance dimension are also similar. Hofstede's and GLOBE's individualism and collectivism dimensions share similarities, but GLOBE further classifies collectivism as institutional collectivism and in-group collectivism. Lastly, Hofstede's masculinity dimension is like GLOBE's societal assertiveness' scale. Venaik, Zhu and Brewer (2013) mention that Hofstede long-term orientation dimension and GLOBE future orientation dimension capture various aspects of time orientation of societies [37]. Hofstede's long-term orientation focuses on the past (tradition) versus future (thrift) aspect of societies, while GLOBE future orientation dimension captures the present versus future (planning) practices of societies. The GLOBE future orientation dimension also reflects societal aspirations and preferences for planning. Although criticisms regarding the inconsistency for Hofstede uncertainty avoidance and masculinity national culture dimensions exist [38], the study provides

National Culture Dimensions	Description
Power distance - (Hofstede, GLOBE); Hierarchy - (Schwartz)	Power distance is the extent to which people with less power expect and accept that the decision-making power is distributed unequally [11][43]. A hierarchical culture alludes to unequal power, roles, and resource distribution in the society, which can be seen in social constructs such as social power, authority, humility, and wealth [7].
Individualism & Collectivism - (Hofstede, GLOBE); Uncertainty avoidance - (Hofstede, GLOBE); Intellectual Autonomy & Conservatism (also called Embeddedness) - (Schwartz)	Individualism is the acceptance that people in a nation have learnt to act as individuals, whereas collectivism is where people act as a member of a group. The Individualism dimension of national culture is classified from collectivist to individualist [44]. Uncertainty avoidance refers to whether people in a nation prefer structured over unstructured conditions which is classified from relatively flexible to extremely rigid [11]. Intellectual autonomy is concerned with a society being inclined to favour individuals' independent choices, enabling them to follow their own ideas. This society also places emphasis on intellectual qualities such as curiosity, broadmindedness, and creativity [48]. In a conservative society, emphasis is placed on maintenance of the status quo, appropriate behaviour, and members are inclined to be averse to actions that might change the solidary group or traditional orders such as social order, respect for tradition, and family security [7]. People are also viewed as entities who are embedded in the collective. The meaning of life is closely related to the social relationship through the identification of groups and participation in a shared way of life and their goals [47].
Masculinity / Assertiveness - (Hofstede, GLOBE); Egalitarianism - (Schwartz)	Masculinity is the degree to which masculine values prevail over feminine values. Masculine values include assertiveness performance, success, and competition, and is classified in a range from tender to tough. Feminine values include warm personal relationships, modesty, quality of life, service, and caring for the weak [11]. Assertiveness refers to the extent to which individuals in organizations or societies are assertive, confrontational, and aggressive in social relationships [43]. Egalitarianism is the opposite of hierarchy. Egalitarian societies expect people to sacrifice selfish interests to have voluntary commitment to promote the social welfare of all people in terms of quality, social justice, freedom, social responsibility, and honesty [47].
Long-term orientation (Hofstede)	Long-term orientation is "the fostering of virtues oriented toward future rewards, in particular, perseverance and thrift" (Hofstede as cited by Zhao, 2015, p. 17). This refers to a nation's time orientation and is characterized by "patience, perseverance, respects for older, tradition and ancestors, obedience sense and the duty towards the larger good" (Zhao, 2015, p. 18).
Future orientation - (GLOBE)	Future orientation refers to the extent to which individuals in organizations or societies engage in future-oriented activities such as planning, investing in the future, and delayed gratification [3].
Indulgence - (Hofstede)	In an indulgent culture it is deemed good to be free. Acting on impulses of what one wants to do is viewed as a good thing. In a restrained culture, the general sense is that life is hard, and that duty, not freedom, is the normal state of being [11].
Performance Orientation (GLOBE)	Performance orientation refers to the extent to which an organisation or society encourages and rewards group members for performance improvement and excellence [43].
Humane Orientation (GLOBE)	Humane orientation refers to the extent to which individuals in organisations or societies encourage and reward individuals for being fair, altruistic, friendly, generous, caring, and kind to others [43].
Mastery versus Harmony (Schwartz)	Mastery societies are focused on self-assertion in that ambition, success, courage, and competence are highly admired, and the belief that society needs to develop and grow [47]. Harmony is the opposite of mastery. Harmony suggests that the culture desires to reach harmony in the environment which includes keeping unity with nature, protecting the environment, and improving the world [47].
Affective autonomy (Schwartz)	Affective autonomy is regarding a culture that encourages individuals to pursue experiences that have a positive effect, for example pleasure, a lifestyle of excitement, and a varied life [48].

Findings for both extremes of these dimensions in the context of South African Agile software development teams.

Hanges and Dickson (2004) compared the GLOBE national culture dimensions to the Schwartz national culture di-

mensions. Their findings were that Schwartz's Hierarchy dimension positively correlated with the GLOBE power distance cultural values scale which means that these dimensions are the same. Secondly, the Schwartz's intellectual autonomy dimension was significantly negatively related to the GLOBE

uncertainty avoidance cultural values scale which means that they can be considered as opposites of each other. Thirdly, the Schwartz's embeddedness dimension had a significantly positive correlation with the GLOBE uncertainty avoidance cultural values scale, meaning that these dimensions are the same. Fourthly, the Schwartz's egalitarianism dimension had a significantly positive correlation with the GLOBE gender egalitarianism cultural values scale, meaning they are the same. Lastly Schwartz's egalitarian national culture dimension also had a significantly negative correlation with the GLOBE assertiveness cultural values scale, which translates to them being opposites of each other.

Based on the similarities identified by Hanges and Dickson (2004), Hofstede's and GLOBE's power distance, and Schwartz' hierarchy dimensions have been combined as *power distance*; Hofstede's individualism as well as the GLOBE's institutional collectivism and in-group collectivism dimensions have been combined as *individualism vs. collectivism*; Hofstede's and GLOBE's uncertainty avoidance as well as Schwartz' intellectual autonomy and embeddedness have grouped as *uncertainty avoidance*; Hofstede's masculinity, the GLOBE's assertiveness, and egalitarianism dimensions, as well as Schwartz' gender egalitarianism national culture dimension have been grouped together as *masculinity*.

Hofstede's long-term orientation, and indulgence national culture dimensions; the GLOBE's future orientation, performance orientation, and humane orientation national culture dimensions, as well as Schwartz' affective autonomy, and mastery versus harmony national culture dimensions had no proven similarity with other culture dimensions. Hence, they were discussed as separate national culture dimensions.

IV. METHODOLOGY

The section describes the research methodology followed for this study. The study employed a subjectivist and qualitative stance. The questions in the study were "how" questions in that the researcher wanted to describe how national culture dimensions impact on Agile artifacts in the South African context. The data that emerged was descriptive meaning that the data was reported in words instead of numbers [39]. This paper was written from an interpretivist paradigm perspective. The research question was answered using a deductive research approach, using a framework which informed the coding process [40].

Data was collected using qualitative semi-structured interviews. Initial interview questions aimed to set the context for the rest of the interview. The national culture dimension questions required the participant to expound on the responses given in relation to the culture dimension and the influence it exerted on the Agile artifacts. The researcher probed into unexplored themes that arose or asked the participant to clarify where the researcher felt more information could be retrieved regarding the context. A cross-sectional timeframe was chosen. No previous data was used, and no data was collected

after write-up of analysis. The data was collected over about a six-month period from December 2020 to May 2021.

Purposive sampling was used in this study. Within purposive sampling, judgmental sampling was specifically used as the researcher targeted participants who could provide the relevant information to meet the objectives of the study [41]. The target population was Agile practitioners within the software development context. Interviews were held with participants from various roles within the Agile methodology as well as management to get a different perspective which was often a more holistic view than the responses from a team member. Participants were asked about all the various artifacts and ceremonies within the Scrum framework. Furthermore, the researcher also targeted participants from a wide range of cultural groups in South Africa. Twenty-six semi-structured interviews were conducted with various project team members and stakeholders such as the Scrum team, Product Owner, Scrum Master, management, end-users, and customers across different teams and companies in South Africa. The interviews were held via digital video communication platforms such as Google Meet, Microsoft Teams, and Zoom. All interviews were transcribed. The participants' demographics are shown in Table. 3.

V. FINDINGS & DISCUSSION

This section is organized as follows. For each dimension, the empirical results are first presented including relevant quotes. Theoretical propositions are then formulated, and the findings are then compared to literature.

A. Agile Use in South African Agile Teams

Some teams in SAFe used a combination of Scrum and Kanban. Scrum in a SAFe team was used for big projects, whereas Kanban was used for maintenance and support work. Some members of the team would normally alternate on the standby and maintenance schedule. Scrum roles, ceremonies and artifacts were generally followed moderately. In more pure Scrum teams, the framework is used for products and all software development work which includes handling technical debt, doing support work, new requirements and enhancements, production issues and complex projects.

B. Overview of Artifacts in South African Agile Teams

In large-scale Agile teams that use SAFe, traditional Scrum artifacts were used. The Product Backlog, Sprint Backlog, Increment, including developer release notes, test evidence, Trello Board for defects, and feedback from production were used as artifacts. In the financial sector, the team used the whole Scrum framework with processes and artifacts, but they have not introduced the notion of the Product Goal yet. This was of particular interest to them as the participant who was the Agile Coach (P21) mentioned, "The Product Goal is more

1 TABLE III.
RESPONDENTS' DEMOGRAPHICS

Person	Role	Race	Years of experience in role	Team Size
P1	Scrum Master	Black	5 yrs.	16-25
P2	Agile Coach	White	8 yrs.	7
P3	Scrum Master	White	1 year	9-13
P4	Agile Coach	Coloured	3 yrs.	12
P5	Product Owner	White	3 yrs.	4-7
P6	Technical Product Manager	White	5 yrs.	4-11
P7	Credit Analyst	Black	8 yrs.	12
P8	Agile Coach	Black	2 yrs.	13
P9	Scrum Master	White	2 yrs.	6
P10	Product Owner	Coloured	1 year	8
P11	Scrum Master	White	5 yrs.	8-9
P12	Agile Project Manager	Coloured	1 year	12
P13	Project Manager	Coloured	5 yrs.	6
P14	Application Support Specialist	Coloured	1 year	20
P15	Solutions Architect	White	8 yrs.	8-9
P16	Agile Coach	White	1 year	~14
P17	Scrum Master	White	6 yrs.	15
P18	Agile Coach	Indian	5 yrs.	7
P19	Agile Coach	White	1 year	7
P20	Head Of Application Development	White	4 yrs.	5-10
P21	Agile Coach	White	5 yrs.	~10
P22	Product Manager	White	1 year	6
P23	Scrum Master	Coloured	5 yrs.	6
P24	Centre of Excellence Manager	Indian	6 yrs.	6-9
P25	Business Analyst	Coloured	2 yrs.	6-7
P26	Agile Coach	White	1 year at organization 9 yrs. in role	3 teams of ~ 5 people

measurable than the product vision". In Scrum teams the Product Backlog, Sprint Backlog (in TFS or Trello), Sprint Reviews, demos, Increment (working software), including Burndown charts, are common artifacts. Additional artifacts are Quarterly Planning Roadmap, Long Term Product Strategy, Product Goal, T Shirt sizing session, user stories, process flows, summarized notes, Vision Board for the Product Backlog, Acceptance Criteria Specifications, Process Flows and User Stories, task board, knowledge base, vision statement, Impact Planning, Vision Mapping, Assumptions Mapping, Empathy Mapping, User Journeys, User Story maps, Minimum Viable Product (MVP), Release Plans, Architectural Runway Designs, and Magic Estimation.

C. Power Distance and Agile Artifacts

According to the findings, in companies where a low degree 42 power distance is manifested, the team is responsible for the product vision, the Product Owner 10 prioritized the Product Backlog with input from the team, the Sprint Backlog

is owned by the team, members take the initiative 43 by selecting user stories from the Backlog to work on, the Definition of "Done" is decided by the Scrum team, the Burndown chart is managed by the Scrum team, and the team delivers Increments regardless of whether the client wants the release: "The team manages the Burndown chart and quite a few of the artifacts in general." (P19). 44

In contrast, in companies that manifest a high degree of power distance, the vision is the responsibility of management and at the business 40 stakeholder level, management has the most influence on the Product Backlog and the amount of work to be completed in the Sprint: "From the organization's point of view, the Product Backlog is managed by management with 30 business." (P9). The team does not own the Sprint Backlog, subordinates expect to be told what to do by authority, the Definition of "Done" is determined by the Product Owner or by management, the Burndown 41 chart is managed by the Scrum Master, and the Increment is the responsibility of

the Product Owner and the stakeholders give input. The definition of done is decided by management." (P9). In line with the above findings, the following proposition is formulated: **Proposition 1: In South Africa, in Agile teams with a high degree of power distance, the Scrum Master and Product Owner instead of the whole team are held accountable for the Agile artifacts.** 45

In summary, in hierarchical teams, the Scrum Master is held responsible for the Agile artifacts although the Scrum Guide prescribes that the Scrum team is collectively responsible and accountable [45]. This is congruent with literature that states that in high power distance teams the Scrum Master is responsible for the Agile artifacts such as the Burndown chart, whereas in low power distance teams a different team member is responsible for updating the Burndown chart everyday [7]. The Scrum Guide emphasizes that the team should take ownership of the Sprint Backlog. Schwaber and Sutherland (2020) elaborate, "The Sprint Backlog is a plan by and for the Developers" [45].

D. Influence of Individualism on Agile Artifacts

The findings reveal that team members in individualistic teams are accountable for various artifacts: "With artifacts, there is an expectation to be involved overall for the team. Generally, there is a bit of a barrier to that and separation; for example, you would do what is in your lane instead of everyone working together on something. They were looking at who was accountable for something." (P4). In contrast, collectivist teams work together on Agile artifacts and review each other's work: "There is no commitment made by the Product Owner before it is discussed with the team or if it is something that they don't think that they can cope with. There will be a collective decision, even though we allow and encourage individual growth. We want to see growth for the person and the product." (P23). In line with the above findings, the following proposition is formulated: **Proposition 2: In South Africa, in Agile teams with a high degree of individualism, each member is accountable for their own artifacts produced.**

There was no literature to compare the study findings to. However, individualism was previously predicted to be more suitable for Agile implementations, whereas the findings in this study suggest otherwise. Working together on artifacts relate to the Agile values of collaboration and interactions [1].

E. Influence of Uncertainty Avoidance on Agile Artifacts

According to the findings, large companies or new Agile/Scrum teams were not comfortable with ambiguity and demonstrated high uncertainty avoidance. Subsequently, high uncertainty avoidance influenced Agile artifacts such as the Sprint Backlog whereby the team does not take a requirement into the Sprint if there is any uncertainty or ambiguity: "We don't take on a User Story if there is uncertainty and ambiguity." (P3).

Lastly, findings revealed, teams with low uncertainty avoidance used Burndown charts while teams with high uncertainty avoidance do not necessarily track progress with

Burndown charts: "Burndown charts did not add value to the Sprint, so I dropped it. We used it to establish what the team planned to deliver and what they have delivered." (P9). In line with the above findings, the following proposition is formulated: **Proposition 3: In South Africa, Agile teams with a high degree of uncertainty avoidance do not commit to a requirement in the Sprint Backlog if there are any uncertainty or ambiguity, do not willingly welcome changing requirements, and are averse to the use of Burndown charts.**

Our findings supports past claims that states that uncertainty avoidance plays a role in certain software practices, such as requirements being specified upfront, test-first programming, and making early design decisions, in countries with a higher uncertainty avoidance index [10]. In contrast, in support teams that used Kanban, the team has a tolerance for uncertainty and ambiguity, especially when related to production issues (i.e., bugs). The issues are accepted by the team and investigated. As a result, teams' low uncertainty avoidance are more Agile and embrace the Agile value of responding to change over following a plan [1].

This finding does not support literature that states that Burndown charts are more prevalent in uncertainty avoidance cultures [7]. This finding could be different due to two reasons: 1) teams with a high degree of uncertainty avoidance are novice teams and do not get to explore Burndown charts and 2) management used the Burndown chart to blame teams for not performing (P9).

Regarding Burndown chart management, high uncertainty avoidance teams seem more flexible with the use of Burndown charts; however, low uncertainty avoidance teams use the Burndown chart only when the team is in danger of not reaching the Sprint Goal. Therefore, low uncertainty avoidance teams are more flexible in the use of the Burndown chart tool.

F. Influence of Masculinity on Agile Artifacts

According to the findings, in teams with high masculinity, the Scrum Master plays a secretarial role where blocker resolution is concerned. In teams with low masculinity / or high gender egalitarianism, the Scrum Master does not necessarily do admin work such as writing down blockers on the board, but rather acts more as a coach to the team: "In the workspace, everyone brings their upbringing and experiences into the space. In my role, I avoid being the 'Scrummy mummy'. For example, I am not an admin fairy, I don't organize people's birthdays, or touch the board, or check anyone's artefacts, nor organize the team-builds. I think that is something that I love about this role because I can challenge those traditional views." (P19). The team writes down their own blockers on the Sprint Backlog and presents it to the team and resolves its own impediments. In line with the above findings, the following proposition is formulated: **Proposition 4: In South Africa, in Agile teams with a high degree of mastery the Scrum Master plays a secretarial role in the resolution of blockers.**

This agrees with literature that states in masculine teams the Scrum Master writes down the impediments on the board [7]. In terms of the implication for agility regarding blocker

resolution, teams with a low degree of masculinity take accountability for their artifacts and making their impediments transparent.

G. Influence of Future Orientation (present versus future)

1 Agile Artifacts

According to the findings, teams with a high degree of future orientation plan for every Sprint and sometimes prioritize the Product Backlog for two Sprints ahead: "What we did in Refinement was to plan two or three Sprints ahead. We looked at the Backlog and see what is ready for the next Sprint." (P2). Future Orientated teams also have a Roadmap for the delivery of Increments that should be released: "Yes, we use user Story Mapping to tie up with a Roadmap and the Release Strategy." (P18). In contrast, teams with a low degree of future orientation plan only for the next Sprint. In line with the above findings, the following proposition is formulated: **Proposition 5: In South Africa, Agile teams with a high degree of future orientation prioritize the Product Backlog for two Sprints ahead, and have a Roadmap for Increments that should be released.**

Literature states that limiting planning to only a Sprint prevents Developers from thinking ahead, while planning for two or more Sprints ahead helps the Developers focus on the Product Vision and to maintain the bigger picture [46]. Therefore, while Scrum proposed only planning for the next Sprint ahead due to the future being uncertain beyond two weeks, there is value in helping teams see the bigger picture.

1 Influence of Performance Orientation on Agile Artifacts

The outcome of the findings for the performance orientation dimension was as expected from the Globe studies. Findings reveal that in Agile teams where a high degree of performance orientation is manifested, the artifacts are influenced whereby the team strives to complete all items in the Sprint and are highly committed to achieving the Sprint Goals: "Once the team has their goals, they are committed to achieving them and working together to do so." (P3). In Agile teams with a lower degree of performance orientation, due to the teams valuing relationships over results, the team is lenient and has a lower sense of urgency since all items in the Sprint are not delivered. In line with the above findings, the following proposition is formulated: **Proposition 6: In South Africa, Agile teams with a high degree of performance orientation thrive to complete all items in the Sprint, are committed to achieving Sprint Goals, and have a fixed Definition of "Done".**

According to the findings, in South African Agile software development teams in general, success is measured mostly by whether the features and stories in the Sprint are delivered. In teams with a high degree of performance orientation, the Sprint stories and features are approximately 80% completed. In contrast, in teams with a seemingly low degree of performance orientation, items on the Sprint Backlog are approximately 60% completed. This is due to teams being mostly focussed on production issues rather than the Sprint. Therefore, we can deduce that there are no implications for agility since

production issues and new feature work contributed to the Increment. In addition, where a high degree of performance orientation is manifested, the Definition of "Done" is defined up front and work done is signed off after the stakeholders complete their testing during User Acceptance Testing. In teams with a seemingly low manifestation of performance orientation, a fixed and documented Definition of "Done" does not exist."

1 Influence of Mastery versus Harmony on Agile Artifacts

The findings reveal that teams that lean toward the mastery national culture dimension have many innovative features or improvement items as part of the Sprint Backlog based on the feedback in the Retrospective meetings: "The team is major focused on that. The problem is sometimes to dial them back because they are always coming up with new ideas. But we are still delivering to clients, so we need to focus on improving the delivery of the product." (P20). In line with the above findings, the following proposition is formulated: **Proposition 7: In South Africa, Agile teams with a high degree of mastery has many innovative features or improvement items as part of the Sprint Backlog based on the feedback in the Retrospective meetings.**

This finding was expected based on the mastery trait of the belief that society needs to go through development [41]. In contrast, the findings suggested that harmony teams accept the Agile artifacts such as the Product Backlog and the various templates as is without the need to change these artifacts. This finding was expected based on the harmony trait of being at harmony with the environment without wanting to change, direct or exploit [47]. Agile Coaches interviewed recommend that newer teams use Agile practices as prescribed, and then adapt based on the results inspected. Mastery teams display the Agile principle: At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly [45].

2

VI. CONCLUSION

Culture can be an impediment to Agile implementations in that cultural issues can cause a lack of trust, challenges collaboration and diminishes collective ownership and team success. There exist many empirical studies that have investigated the relationship between organizational culture and the deployment of Agile. However, few studies have focused on the influence of national culture dimensions Agile Implementations, especially in the South African context. This study provides a useful contribution to research and practice as it provides insights into the role of a consolidated set of cultural dimensions on Agile artifacts.

Seven propositions have been formulated to highlight how Hofstede (2013) and GLOBE (House et al., 1999) national culture dimensions influence Agile artifacts. The findings reveal that various national culture dimensions influence accountability for artifacts, commitment to a requirement in the Sprint Backlog, welcoming of changing requirements, Burn-down chart management, blocker resolution, Product Backlog

planning, Roadmap for Increments, completing items in the Sprint, commitment to Sprint Goals, Definition of "Done", number of innovative features or improvements in the Sprint Backlog.

From an artifacts perspective, South African Agile teams manifesting low power distance is deemed as being more agile since the team members update artifacts which is prescribed by the Scrum guide. Collectivist South African Agile are also more agile than individualist South African Agile teams since these teams displayed the Agile value of collaboration and interactions. The South African collectivist being more Agile than the South African individualist trait therefore deviated from the expected outcome as predicted by literature. Teams that manifested low uncertainty avoidance were more flexible in the use of Burndown charts, whereas teams with high levels of uncertainty avoidance did not use burndown charts since these teams were generally novice teams and management historically used the Burndown chart to blame the team for poor performance. Contrary to predictions by prior literature, teams with a low degree of masculinity are more suitable for Agile implementations take accountability for their artifacts and making their impediments transparent.

The findings not only contribute to theories around the impact of culture in Agile teams, but also provide key insights to practitioners on what cultural manifestations might be at play in their project teams. It is important to understand the cultural driving forces at play behind the challenges that they might be experiencing. The findings can help inform Agile implementations in practice, and therefore help managers and teams curate Agile teams for appropriate environments.

Most of the respondents provided input in relation to the Scrum framework. Future studies could focus on a wider sample of respondents with experience in a broader range of Agile frameworks. Future studies could also focus on the influence of national culture dimensions on Agile implementations in teams other than those in software development. A longitudinal study could be conducted to obtain deeper insights into the cultural manifestations over a longer period. This might provide more insights into how teams cultural traits changes over time as the teams mature. Further opportunities to explain the findings with other theoretical frameworks such as Complex Adaptive Theory (CAS) also exist.

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APPENDIX

Appendixes, if needed, appear before the acknowledgment.

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