

ADOPTION OF EMERGING TECHNOLOGIES IN THE SOUTH AFRICAN OUT-OF-HOME ADVERTISING INDUSTRY

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DOI: <https://doi.org/10.5281/zenodo.12191596>

Abstract: The shift to the 4th Industrial Revolution (4IR) promises to increase productivity and enhance the quality of life through the adoption of emerging technologies. In the context of the Out-of-Home (OOH) advertising industry, the 4IR era is characterized by the use of advanced technologies to deliver targeted, immersive advertising experiences. This study aims to investigate the readiness and challenges of the South African OOH advertising industry in adopting technologies such as the Internet of Things (IoT), big data, machine learning, and advanced real imaging technology. Without this shift, the industry risks missing out on significant revenue growth opportunities. The study develops a customized framework for South African OOH advertising organizations to transition towards the 4IR, using a technology adoption model to highlight the main actors, current state, and constraints. The findings contribute to the body of knowledge on 4IR transformation strategies, offering insights that are applicable not only to the OOH advertising industry but also to other sectors looking to embrace emerging technologies.

Keywords: Advertising, out of home, fourth industrial revolution, emerging technologies, technology adoption.

INTRODUCTION

Advertising leverages human senses to draw attention to specific needs, products, or services, with primary objectives to inform, persuade, and remind. Out-of-Home (OOH) advertising, one of the oldest forms of advertising, traces its origins back to ancient Egyptian hieroglyphics (Frolova, 2014). Over the centuries, significant advancements have shaped its evolution, from the invention of movable type printing by Johannes Gutenberg in the 1400s to the introduction of lithography in 1796, which paved the way for modern posters and billboards (BMediaGroup, 2019; The Operators, 2015). The late 20th century witnessed the digital transformation of static billboards into dynamic displays driven by the 3rd Industrial Revolution.

Present-day OOH advertising has evolved beyond simple static displays to include larger-than-life digital advertising signs. Historical data shows that OOH advertising accounted for 6.5% of the total global advertising spend in 2018, with a slight decline to 6.4% in 2021, partly due to the impact of the COVID-19 pandemic (OOOA, 2019). The industry is witnessing a shift from traditional static signs to digital formats, enabling advertisers to demand higher fees for more immersive experiences and increase inventory through multi-brand projections. In 2018, Digital Out-of-Home (DOOH) advertising generated nearly \$6 billion globally, with projections to reach

\$15.9 billion by 2027, reflecting a double-digit Compound Annual Growth Rate (CAGR) (Statista Research Department, 2021).

The South African OOH advertising market is dominated by major players such as JCDecaux, Primedia Outdoor, Adreach, Provantage Media, and Outdoor Network. Transformation, defined as the process of converting something from one state to another for specific reasons (Merriam-Webster, 2021), is critical for the South African OOH industry to transition towards the 4IR. According to Schwab (2016), the 1st Industrial Revolution harnessed water and steam power, the 2nd utilized electricity, and the 3rd brought the internet and electronics. The 4th Industrial Revolution is marked by the convergence of biological, physical, and digital worlds through breakthroughs in cloud computing, IoT, robotics, AI, advanced wireless technologies, 3D printing, nanotechnology, biotechnology, energy storage, virtual and augmented reality, big data, and autonomous vehicles.

The 4IR offers numerous advantages, including increased productivity, improved quality of life, lower barriers to entrepreneurship, and the creation of new markets. However, it also presents challenges such as ethical issues, widening inequality gaps, cybersecurity risks, and potential disruptions across industries. For the OOH advertising industry, the integration of 4IR technologies like big data, AI, IoT, and high-tech video capabilities is transforming traditional practices, enhancing the ability to provide interactive, personalized advertisements using sensors, cameras, GPS, and facial analytics technology.

This study focuses on the adoption of emerging technologies in the South African OOH advertising industry, aiming to develop a framework for a successful transition towards the 4IR. The research addresses key questions: Who are the actors in the South African OOH advertising industry, and what is the current state of play? What constraints prevent the industry's shift to the 4IR? How can the South African OOH advertising industry navigate this transition? By exploring these questions, the study seeks to contribute to the understanding of technology adoption in the 4IR context, providing valuable insights for the broader application of these technologies across various sectors.

LITERATURE REVIEW

Advertising ecosystem

The role of advertising, which is to inform an audience about a particular topic, has largely remained unchanged for centuries. Lopez-Pumarejo and Bassell (2009) state that though the role remains largely unchanged, what has changed is the variety of mediums used to reach the target audience. Gadek (2021) states that at its most basic form, the landscape of advertising comprises the supply side and the demand side when looking at it from an operational perspective. That is, there are those who are willing to sell advertising space and there are those who want to buy advertising space.

The supply side of the industry includes media owners, and as the name suggests they own the infrastructure or platforms. The infrastructure or platforms could range from television channels, radio stations, social media applications and even billboards in the case of outdoor advertising. The supply side of the industry also includes media inventory management companies also known as publisher networks or inventory vendors which can be contracted by media owners to assist with the selling process (Kovalenko, 2021). The demand side also known as the “Buy” side of the advertising ecosystem are organisations and people that purchase space to advertise on the media owners’ infrastructure or platforms. In some cases, the organisations might purchase advertising space directly from the media owners and in some cases they might use marketing agencies.

Most multinational companies rely heavily on advertising. Their marketing budgets are used to advertise in a variety of media forms so as to try and reach as many users as possible. In the year 2021, the five brands with the largest annual marketing spend were P&G, Amazon, L’Oreal, Samsung and Alibaba (Wilson, 2021). While the five largest Out-of-Home advertising organisations, also known as media owners, based on their annual revenue as ranked in the year 2018 were JCDecaux, Clear Channel, Focus Media, Ströer and Lamar (Coulibaly, 2019). In the South African Out-of-Home advertising industry, the five largest media owners are JCDecaux, Primedia Outdoor, Adreach, Provantage Media and Outdoor Network (Liebenberg, 2014). Upon review of available literature, it became apparent that different countries and advertising industries have different ways of classifying the OOH advertising media that form part of the industry. The Out-of-Home Media South Africa (OHMSA) classifies OOH media formats under eight headings. That is, billboards, street furniture, activations, moving transit media, retail media, stadium media, static transit media and digital Out-of-Home media (OHMSA, 2020).

The South African advertising industry’s self-regulation and lack of clear government policies have brought to light issues in addressing the low levels of multilingualism in the industry. This issue is particularly important in the context of South Africa as it has 11 official languages. Owing to globalisation the local and global advertising industry has become focused on seeing the world as one unilingual marketplace (Cawood and Du Toit, 2006). This is particularly concerning in South Africa since the constitution envisions multilingualism and diversity in all spheres of society, however the reality is that the South African advertising industry is English unilingual in nature which could be a result of scarce resources to accommodate all official languages and the perception that the English language has the broadest and best indiscriminating reach.

South Africa unlike other countries has another dimension that it needs to contend with across all industries. That is, Black Economic Empowerment (BEE) which is a mechanism that government regulators have put in place to alter the racial profile of management and ownership in all industries with the intention of addressing the injustices of apartheid that promoted the marginalisation of the black community. Duffett et al. (2009) state that while the transformation process is still ongoing, its success will ultimately be determined by individuals, organisations and government working together.

A global issue has been raised by Topić (2021) regarding the role that women play in the advertising industry particularly the glass ceiling they’re faced with and the pay gap that exists between men and women in the industry. It has long been argued that the way in which women and men socialise in the office can lead to structural inequality with women feeling that they need to work harder. This is mainly due to the perception that the advertising industry is a man’s world, and its work culture exhibits masculine dispositions that automatically segregate women and hinder their progress (Topić, 2021).

Fourth industrial revolution within society

It would be easy to get lost in the hype that is currently surrounding the 4th Industrial Revolution as the phrase has been taken up by many different people, organisations and governments without providing any specifics of what is actually meant by the 4IR. Barton (2020) does, however note that while the term is vague, the 4th Industrial Revolution is actually the interaction across the physical, biological and digital space through the use of technology. This interaction can form new industries or morph existing industries into a new way of doing business. Ahn (2020) used the terms superintelligence, hyper-connective, and ultra-reality to describe the core characteristics of the fourth industrial revolution. Enaifoghe (2021) states that one of the main constraints facing

African countries in particular is the lack of clear government policies. These policies together with investments in education and the reskilling of the population could greatly accelerate the process of the digitalisation of African economies in the 4th Industrial Revolution.

Until recently the South African government did not have a dedicated body that deals with the 4th Industrial Revolution. The Council for Scientific and Industrial Research (CSIR) in 2021 was given the role as the hub for the 4th Industrial Revolution in South Africa. It will assist government in spearheading government policy all with the intention of accelerating the process towards Industry 4.0 (Council for Scientific and Industrial Research, 2021). The centre's Industry 4.0 role is not only limited to regulatory policy but also to:

- (1) Create a platform for business to work with government and academia
- (2) Focus on accelerating the adoption of 4IR technologies
- (3) Act as a catalyst in the industry through business and government fellowships
- (4) Provide advice and assistance to Small, Medium and Micro Enterprises (SMMEs)

Kumar (2018) notes that while the 4th Industrial Revolution brings forth opportunities such as value for money and increased productivity, it does however pose a challenge in ensuring that the jobs lost through the 4th Industrial Revolution transition are supplemented by new jobs. Hizam-Hanafiah et al. (2020) state that the six most important dimensions that relate to the transformation towards the 4th Industrial Revolution is: Technology, People, Innovation, Strategy, Leadership and Process.

Fourth industrial revolution advertising technologies

There are several advanced real imaging technologies but the three that mainly relate to advertising are virtual reality (VR), augmented reality (AR) and mixed reality (MR). VR completely immerses a user within a digital environment. Uyar (2020) states that studies indicate that VR advertisement is a more effective way of interacting with an audience as it provide a unique experience. AR is real-time image computing that combines virtual information and the real world to form an environment that allows overlays of digital information onto the real world (Yan, 2014). MR is a blend of VR and AR capabilities that allow physical and digital objects to coexist and interact in real time (Moore, 2020). OOH advertising campaigns that use VR, AR, MR technology are better positioned to provide an emotional, cognitive and aesthetic experience to the audience.

Malthouse and Li (2017) describe big data as large amounts of data that are generated at a high velocity from a variety of sources. In the advertising industry, big data is regarded as the volumes of data generated between the audience and the brand through digital interaction. Malthouse and Li (2017) refer to this as digital touch points. In the OOH advertising industry, touch points could be facial recognition software aided by cameras, radio frequency identification (RFID) technology, touchscreen technology, a variety of sensors and advanced real imaging technology. These technologies can allow the audience to interact or affect the advertising, thus generating large volumes of data. With the generation of big data, proper use of it by advertisers can allow them to make better decisions such as which message to display, when to display it and who to display it to.

The 3rd Industrial Revolution heralded information technology that assisted in the processing and transmission of data. The decision-making process was however human. The new shift to the 4th Industrial Revolution through emerging technologies such as machine learning, which is a subset of Artificial Intelligence, allows computers to make reliable appropriate decisions (Syam and Sharma, 2018). Big data acts as an input to machine learning algorithms. Through the processing of these datasets by machine learning algorithms, the algorithms have the

ability to make changes over time to their already preloaded decision algorithms without human interaction, all while providing better decision-making, thus negating the need for humans to get involved (Yu et al., 2019). Machine learning is a great tool for an OOH advertising organisation to have at its disposal as it enables for targeted audience advertising within the industry.

Technology adoption

There are several factors that may affect the rate of adoption of technologies such as machine learning, big data and real imaging technologies. These factors may go as far as hindering the technology adoption process.

One such variable is the level of literacy of the population of a country. Haapaniemi and Makinen (2009) clarify this further by stating that a country that has a high rate of illiteracy in the population may be detrimental to the introduction and adoption of new technologies as most technological innovations require a certain level of literacy as a prerequisite to their use. Sufian et al. (2021) note that another issue that could limit the adoption of technologies could stem from a lack of a clear strategy by an organisation. This is particularly true in the case of Small, Medium and Micro Enterprises (SMMEs), as they generally do not have the resources and skills to those of large corporations. Sen et al. (2010) discuss how incumbent technologies can act as a barrier or constraint to the wide adoption of newer technologies. This unintended barrier stems from users preferring the familiarity of older technologies to newer technologies.

Several adoption theory models were developed during the last half of the 20th century. These conventional adoption theories are not only being used as the basis of the technology adoption theory but are recognised as valid tools that can shed light on understanding the technology adoption phenomenon (Vale Martins et al., 2021). Vale Martins et al. (2021) further note that these adoption theory models were developed and applied in

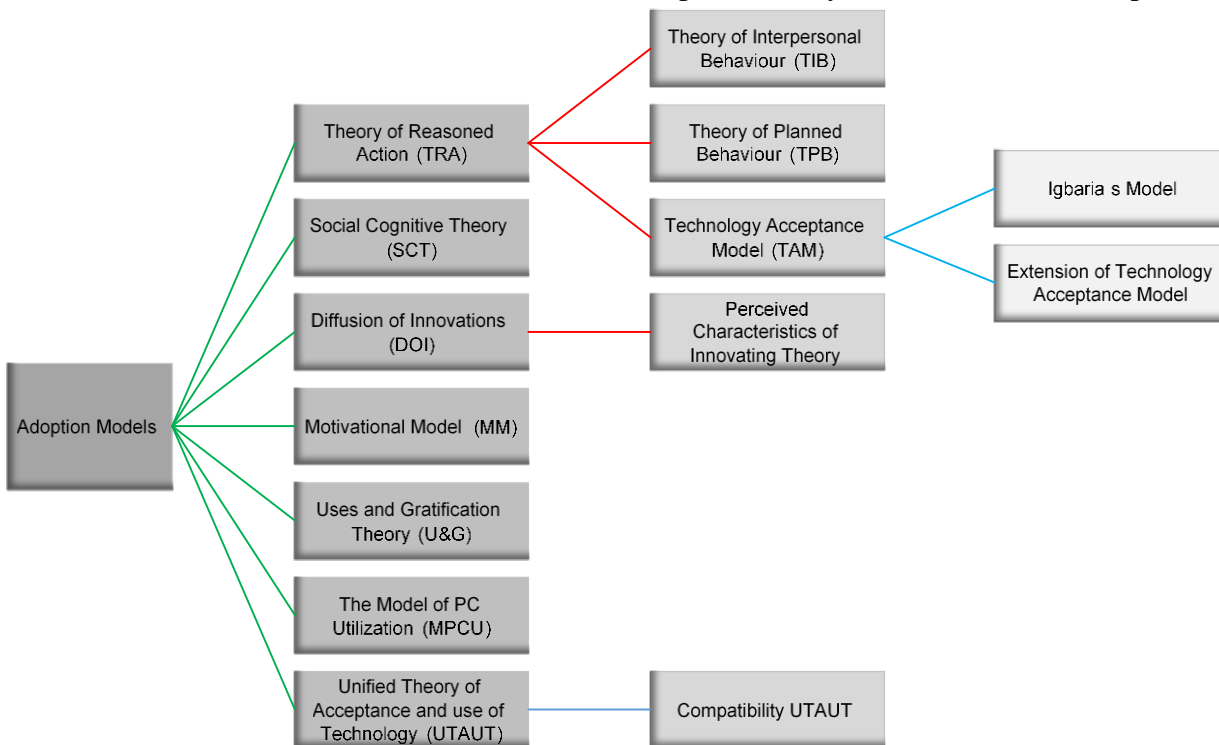


Figure 1. An overview of popular technology adoption models and theories.

Source: Taherdoost (2018).

the context of the development and functioning of human society, while also assuming that technological adoption always reflects a social change.

Figure 1 represents an overview of some of the technology adoption models and theories.

One of the most widely used technology adoption models is the Unified Theory of Acceptance and Use of Technology (UTAUT). It has been touted to achieve great success in adoption process outcomes of new innovations from an organisational perspective (Faqih and Jaradat, 2021).

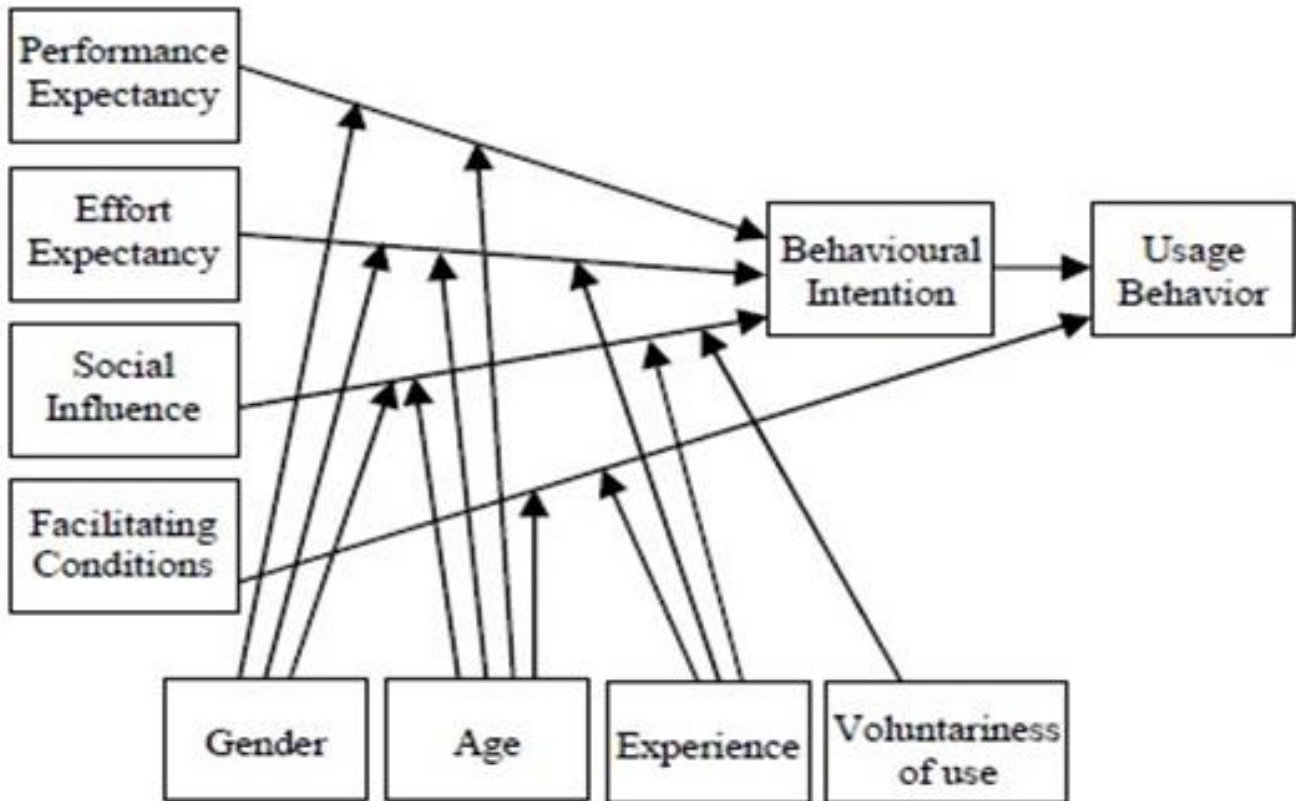
Figure 2 depicts a UTAUT model while also showing the relationship between the core constructs and the moderating variables. As was noted earlier, the UTAUT model employs an organisational perspective. In recent years, researchers have adopted the UTAUT model and have added a few more constructs. This was to allow the original model to also focus on the consumer perspective when it came to technology adoption. This new model is termed UTAUT2, and it adds three more constructs, namely, price value, habit, and hedonic motivation (Primasari, 2016). The research study will mainly focus on the UTAUT2 theory as it has proven to be a success in the adoption of various technologies in different industries; with the OOH advertising industry being no exception.

The OOH advertising industry in South Africa consists of four major players, JCDecaux, Primedia, Provantage Media and Outdoor Network with the bulk of the market dominated by Small and Medium-Sized Enterprises (SMEs) (Liebenberg, 2014). Kademeteme and Twinomurinzi (2019) found that South African SME owners in all industries need to stop focusing on the characteristics of the SME when conducting an evaluation of adopting emerging technologies. Emphasis should rather be placed on issues such as their capability of improving customer satisfaction, increasing efficiency of the business on all levels through the adoption of the 4th Industrial Revolution emerging technologies. Kademeteme and Twinomurinzi (2019) proposed that previous models used for evaluation be re-visited and proper evaluation models that are applicable to the current 4th Industrial Revolution be developed. This should also apply to the OOH advertising industry in South Africa

Conceptual method

Industry actors and state of play framework

Figure 2. United theory of acceptance and use of technology model.



Source: Venkatesh et al. (2003).

At its most basic form, the South African OOH advertising industry ecosystem is made up of actors who can be grouped under the banner of demand-side, supply-side or external factors/stakeholders. The demand-side actors are made up of advertisers and media agencies while the supply side is made up of media owners, ad networks and the audience/consumers. External actors who play a major role within the industry are government regulators, technology suppliers, Advertising Regulatory Board (ARB), contractors and consultants.

The concepts that relate to the state of play of the South African OOH advertising industry that were investigated were English unilingualism with the industry, Black Economic Empowerment (BEE) transformation, diverging interests within the OOH advertising ecosystem and the gender barriers faced in advertising organisations.

Industry constraints framework

The South African OOH industry constraints framework was set up to validate the main constraints that were first identified through a comprehensive review of the literature. Nine factors were identified as having the ability to stifle the transformation towards the 4th Industrial Revolution. They are infrastructure development, technology application, legacy technologies, funding, skills development, socio-economic issues, not having a clear strategy and vision, education shortfalls and the inability to have a clear understanding of the benefits associated with transforming towards the 4th Industrial Revolution.

Proposed technology adoption model

The basis of the proposed technology adoption model stems from the modified Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) technology adoption model proposed by Primasari (2016) together with the Unified Theory of Acceptance and Use of Technology (UTAUT) model proposed by Venkatesh et al. (2003). The proposed technology adoption model consists of eight constructs or factors that determine the behavioural intention of whether organisation chooses to adopt technologies. They are the performance expectancy, ease of use, price or value, social influence, hedonic motivation, technology maturity, 4th Industrial Revolution technology acquisition and 4th Industrial Revolution technology application. It is proposed that the eight technology adoption factors be moderated by four market characteristics, also referred to as traits. They are the company characteristics, product characteristics, industry characteristics and geographical characteristics.

Conceptual framework

The framework is built on establishing the constraints; state of play and the main actors in the South African Out-of-Home advertising industry. Once established, the constraints, actors and state of play act as inputs to the proposed technology adoption model which is a major process in transforming the South African OOH advertising industry towards the 4th Industrial Revolution. The propositions that relate to the study are:

Proposition 1 (P_1): A clear understanding of the actors and state of play of the South African OOH advertising industry has a direct impact on how to assess the factors (that is, theory testing inputs) that allow for successful technology adoption.

Proposition 2 (P_2): A clear understanding and elimination of constraints gives the technology adoption process a better chance of succeeding.

Proposition 3 (P_3): Improvements in all aspects of the factors noted (that is, theory testing inputs) have a positive influence on the behavioural intention of adopting the 4th Industrial Revolution technologies.

Proposition 4 (P_4): Successful technology adoption is a major factor in transitioning the industry to the 4th Industrial Revolution.

RESEARCH METHODOLOGY

A deductive approach was employed in the study in relation to the first two research questions that pertain to the South African OOH advertising industry actors, state of play and constraints. The third research question which relates to the development of a customised framework for the industry to transition towards the 4th Industrial Revolution adopted an inductive research approach.

A single-case study data collection strategy was selected. One of the reasons for choosing to use a single-case study method is its benefit in serving to go beyond just using quantitative data, but also qualitative data to enable the topic under investigation to be better understood, thus allowing for context to be provided (Zainal, 2007). For the purpose of this study and anonymity, the South African Outof-Home advertising media owner under review and where data was collected is referred to as Company X.

Company X comprises eleven functional departments. They are Corporate, Finance, Sales and Marketing, Business Systems, Operations, Digital Design and Control, Information Technology, Human Resources, Asset Management, Administration and the Facilities department. A two-step sampling approach also known as multi-stage sampling was used. The first sampling approach used was purposive sampling. This entailed deliberately choosing which functional departments to include in the study based on whether they potentially had an effect on the decision of organisations in choosing to adopt 4IR technologies. The functional departments that were sampled in the first

stage were the Corporate, Finance, Sales and Marketing, Business Systems, Operations, Digital Design and Control, Information Technology, Human Resources and Asset Management departments. The nine sampled functional departments then went to form the strata of the study. The second sampling phase used was the proportional stratified random sampling. The proportion of the sample for each strata was chosen to be fifty percent with a total of seventy-two questionnaires distributed and fifty employees of Company X choosing to participate in the study.

The first two research questions were addressed using thematic analysis as it offers the advantages of flexibility with respect to the type of data examined and the ability to analyse data using a deductive theory-driven approach. The process of theory generation is underpinned by the collection, analysis and the interpretation of data. Grounded analysis addressed the third research question posed. This made it a favourable analysis choice as it sets out to construct an explanatory theory which is related to an area of study through the use of data (Chun Tie et al., 2019). The collated data was analysed using ATLAS.ti which is a Computer-Assisted Qualitative Data Analysis Software (CAQDAS).

RESULTS AND DISCUSSION

Industry actors

The industry actor's framework and the results collated from the survey addressed the first part of the first research question which is stipulated as:

Who are the actors in the South African OOH advertising industry?

Study participants affirmed that all the listed actors were indeed major actors within the South African OOH advertising industry. However, their level of importance and the role they played within the industry was not viewed the same by the study participants.

Based on the results, eighty-two percent of respondents viewed Contractors and Consultants as being extremely important within the South African OOH advertising industry. This was followed by eighty percent of respondents perceiving Media Owners as being extremely important. Sixty-two percent of respondents agreed that Consumers/Audiences are extremely important within the industry with forty-four percent perceiving Brands and Government Regulators as being extremely important. Forty-two percent of respondents rated Technology Suppliers as being extremely important within the industry with twenty-four percent of respondents viewing Media Agencies as extremely important. A mere sixteen percent of respondents viewed Advertising Networks and the Advertising Regulatory Board (ARB) as being extremely important. Two participants added Landlords as actors during the openended question. Upon review, the assertion made by the respondents held ground as a critical key component of deploying advertising infrastructure is the buy-in from the property or landowner in allowing the placement of billboards on their property through a successful negotiation of a lease agreement.

Industry state of play

Four South African Out-of-Home advertising industry state of play factors were originally investigated. They are language use, women, BEE policy and multi-party relationships within the industry. The second part of the first research question is stipulated as:

What is the state of play in the industry?

With regards to language use within the industry, participants were mainly in agreement that Company X does use English as the primary language in their advertising content. Participants were however neutral on the assertion by the researcher that Company X does not seem to show any interest in accommodating the rest of the

official languages. Sixty-two percent of respondents agreed to strongly agreed that the industry should make a more concerted effort in adopting other official languages while twenty-four percent remained neutral, and the rest disagreed.

The Black Economic Empowerment (BEE) policy is a unique legislative policy that affects every industry in South Africa. Participants were asked if the transformation process that BEE serves to achieve requires cooperation between multiple stakeholders within the South African OOH industry for it to succeed. Fifty-two percent of respondents strongly agreed with that notion while twenty-eight per cent agreed and fourteen per cent remained neutral. The rest of the respondents disagreed with that assertion. Another question that was posed to participants was whether more effort was needed towards the BEE transformation process. Seventy percent of respondents agreed to strongly agreed with that notion while twenty percent remained neutral, and the rest disagreed. Seventy-four percent of participants also agreed to strongly agreed that Company X had shown to embrace BEE within the organisation while twenty-four percent of respondents remained neutral on the matter with the remainder strongly disagreeing. Based on the findings from the respondents, BEE does seem to have been adopted and practised by Company X.

There is a concerted effort around the globe and within multiple industries to push the advancement of women in the workplace in order to address the disparity between men and women when looking at pay gaps and leadership positions. Sixty-eight percent of respondents agreed to strongly agreed that women within Company X occupied management roles within the organisation while twenty-four percent remained neutral on the matter and eight percent disagreed. However, study participants mostly remained neutral on the notion that Company X prioritised the advancement of women within the organisation. Study participant also remained neutral on whether Company X's structure and culture was conducive towards the advancement of women. Based on the 3 elements that were under investigation which relate to women at Company X, the general theme that emerged was that participants gravitated towards being neutral and somewhat agreeing that Company X is doing enough for women within the organisation.

Company X as a media owner within the South African OOH advertising industry cannot function in isolation owing to multiple stakeholders being required for it to meet its mandate to its shareholders. That led to multiparty relationships being investigated in the study. Eighty percent of respondents agreed to strongly agreed that a healthy relationship should exist between media owners and media agencies while sixteen percent remained neutral with the remainder disagreeing. With that said, participants strongly disagreed with the initial assertion made that multi-party relationships need not be maintained. In regard to whether Company X is preoccupied with its own success and not the success of the industry; forty-two percent of participants were neutral on the matter with the rest of the respondents evenly split between agreeing and disagreeing.

An open-ended comment section was provided, and one participant highlighted the ineffectiveness of City Councils to manage their by-laws as a major state of play factor within the industry.

Industry actors and state of play global overview

The industry actors and state of play overview questionnaire section that was posed to the participants focused on affirming or refuting the declarative statement that was posed by the researcher:

Proposition 1 (P_1): A clear understanding of the actors and state of play of the South African OOH advertising industry has a direct impact on how to assess the factors (that is, theory testing inputs) that allow for successful technology adoption.

Taking note, the technology adoption factors (that is, theory testing inputs) comprise performance expectancy, ease of use, price or value, social influence, hedonic motivation, technology maturity, 4IR technology acquisition and 4IR technology application. The results of the industry actors and state of play global overview questionnaire section investigated the relationship between the actors and state of play of the industry against the factors of the technology adoption model. Based on the results, most participants agreed to strongly agreed that the role of stakeholders in the technology adoption process is crucial and that omitting stakeholders from the process will lead to unintended consequences. Most study participants also agreed that stakeholders must decide which factors should be under consideration during the technology adoption process. Accuracy in the measurement criteria during the investigation of the technology adoption factors was also viewed as crucial by the study participants. With regard to the state of play of the industry, the majority of study participants agreed to strongly agreed that it does have the ability to affect the technology adoption factors under consideration and that each factor is affected by the environment. Study participants also affirmed that understanding the South African OOH advertising industry in terms of technology adoption is crucial.

The results affirm the proposition in that, one should not embark on a technology adoption process without having a clear view of the major players within the industry and the state of the environment in which said organisation conducts its business.

Industry constraints

The industry constraints questionnaire section that was posed to the study participants aimed to address the second research question which pertained to identifying the major South African OOH advertising industry constraints that could potentially limit the successful transition towards the 4th Industrial Revolution.

The nine industry constraint factors under consideration were adequate funding, clear strategy and vision, adequate skills, 4th Industrial Revolution specific education curriculum, high switching costs from legacy technologies, clear understanding of 4IR benefits by organisations, socio-economic issues, infrastructure that can accommodate 4IR technologies and the inability of organisation to properly apply 4IR technologies to fit their specific business needs. Based on the results, Figure 3 addresses the question by displaying and grouping the constraints under investigation, starting from the constraint factors that were flagged by the greatest number of research participants to those flagged by the least number of participants.

Further to that, the industry constraints questionnaire section tried to affirm or refute the declarative statement that was posed, that is:

Proposition 2 (P2): A clear understanding and elimination of constraints gives the technology adoption process a better chance of succeeding.

- Skills - Strongly Agree (34%) Agree (60%)
- Funding - Strongly Agree (58%) Agree (36%)
- Education - Strongly Agree (56%)

-
- Agree (40%)
 - Strategy & Vision - Strongly Agree (54%)
 - Agree (42%)
 - Infrastructure - Strongly Agree (52%)
 - RQ2 Agree (40%)
 - _Constraints
 - Technology Application - Strongly Agree (44%)
 - Agree (44%)
 - Clear Understanding of Benefits - Strongly Agree (42%) Agree (50%) • Socio-Economic - Strongly Agree (18%)
 - Agree (44%)
 - Legacy Technologies - Strongly Agree (8%)
 - Agree (38%)
 - Virtual and international Partners - N/A
- (Open-ended response)

Figure 3. A list of all constraints that were under investigation and their ranking.

The results affirm the notion that understanding the constraints and eliminating them does increase the chances of an organisation transforming towards the 4th Industrial Revolution. It should be noted that an organisation cannot transform towards the 4th Industrial Revolution without the adoption of emerging technologies. It thus leads to the conclusion that the technology adoption process is a subset process of the 4th Industrial Revolution transformative process and thus the declarative statement made is true regarding the technology adoption process standing a better chance of succeeding through the elimination or mitigation of constraints.

Fourth industrial revolution technology adoption model

Technology adoption factors and the market characteristics influence: Study participants were requested in the survey to use a matrix chart to highlight if any particular market characteristics had an impact on any of the eight represented technology adoption factors. Technology adoption factors and market characteristics correlations that did not collect enough support by study participants were removed from the model. Table 1 depicts the relationship that exists between the technology adoption factors and the market characteristics based on data collected from respondents.

Technology adoption factors that influence the behavioural adoption intention: Study participants were presented with a series of statements in the survey regarding their level of agreement or disagreement concerning whether the eight proposed technology adoption factors (that is, theory testing inputs) had a significant impact on the behavioural intention. The behavioural intention refers to whether organisations have a desire to adopt 4th Industrial Revolution technologies based on the technology adoption model, it particularly focuses on whether the technology adoption factors have a role in determining that desire. The results of the technology adoption factors in Figure 4 have been arranged to reflect a sliding scale, starting from the greatest level of agreement to the least.

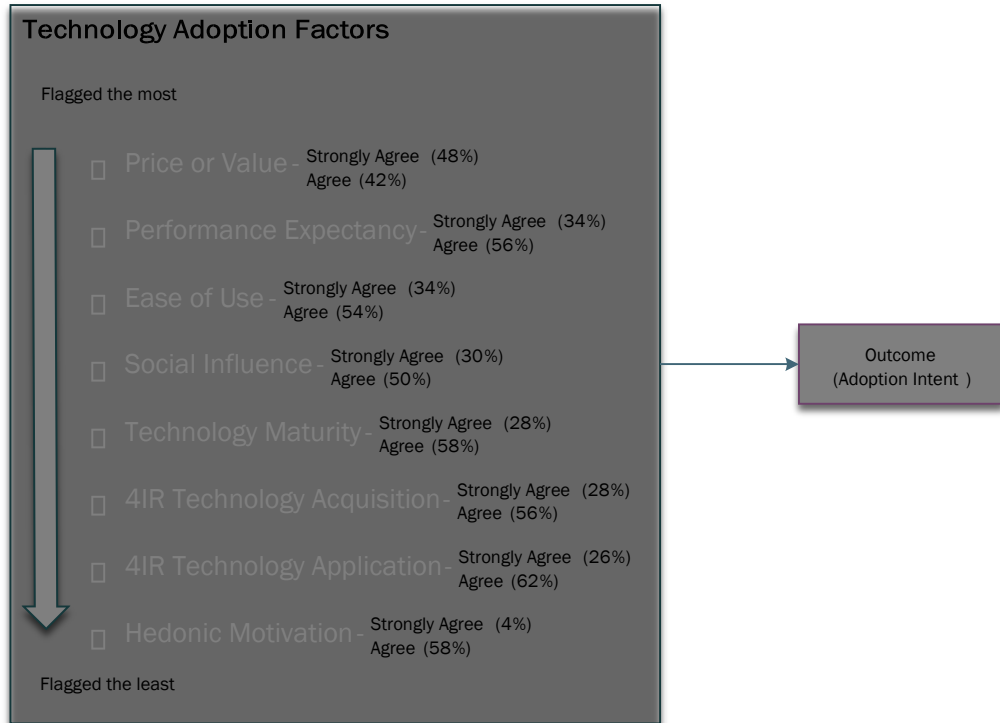


Figure 4. Arrangement of technology adoption factors based on the survey results.

Afr. J. **Table 1.** Correlation between traits and the factors associated with technology adoption process.

Source: Authors

Factor	Traits/Market Characteristics			
	Company Characteristics	Product Characteristics	Industry Characteristics	Geographical Characteristics
Performance Expectancy	<input type="checkbox"/>	<input type="checkbox"/>		
Ease of Use		<input type="checkbox"/>		
Price or Value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social Influence	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
Hedonic Motivation		<input type="checkbox"/>		
Technology Maturity	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
4IR Technology Acquisition	<input type="checkbox"/>		<input type="checkbox"/>	
4IR Technology Application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

The declarative statement that was posed in the conceptual method subsection:

Flagged the most

- Leadership Required - Strongly Agree Agree (28%) (62%)
- Technology Adoption Key - Strongly Agree Agree (42%) (54%)
- Stakeholder Engagement Critical – Strongly Agree Agree (50%) (42%)
- Innovation Key - Strongly Agree Agree (46%) (42%)
- Strategy is Crucial - Strongly Agree Agree (46%) (38%)
- Process is Iterative - Strongly Agree Agree (50%) (26%) Flagged the least

Figure 5. Ranking of 4IR key dimensions based on survey responses.

Proposition 3 (P_3): Improvements in all aspects of the factors noted (that is, theory testing inputs) have a positive influence on the behavioural intention of adopting

4th Industrial Revolution technologies

By virtue of the majority of study participants agreeing that all the technology adoption factors provided have a major role to play in whether organisations choose to adopt 4IR technologies, it could be concluded that the proposition is true. In that, technology adoption factors having an effect on the choices made by organisations

Source: Authors

means that they also have an effect on the behavioural technology adoption intention as initially proposed.

Fourth industrial revolution process

The transition towards the 4th Industrial Revolution within any industry or organisation requires multiple dimensions to realise it. The six most important dimensions as noted by Hizam-Hanafiah et al. (2020) are: Technology, People, Innovation, Strategy, Leadership and Process. Based on the results collated from the study participant responses,

Figure 5 depicts and ranks the 4IR dimensions based on the degree of agreement by study participants in how crucial they are. The 4IR transformation process always starts with a particular need from people. Be it customers, the larger society or an organisation trying to improve its business operations with the hope of gaining a competitive advantage within its set industry. Once a need by people has been established; individuals or organisations set out to be innovative and come up with new concepts that could pertain to their products or processes. It is one thing to innovate, but how to go about leveraging that innovation requires alignment of multiple facets within an organisation. This then leads to an organisation having to develop a clear strategy and vision on how to go about reaping the rewards of said innovation. A strategy can take the form of a document, but without proper buy-in from multiple stakeholders it can easily become just a document. Which is where

leadership is required, as it drives the implementation of the strategy. The successful implementation of the agreed strategy can then ensure that the 4th Industrial Revolution technology adoption process can be successful and thus bring an organisation one step closer to fully transforming towards the 4th Industrial Revolution. The 4th Industrial Revolution is still relatively a new concept and many investments have been made towards 4th Industrial Revolution technologies which become readily available as time goes on. As such, an organisation's 4th Industrial Revolution transformation process is never complete hence the need for the process to begin once again after the technology adoption process is complete.

Taking note of the preceding discussion and the summary of results in Figure 5 and relating it to the declarative statement that was posed by the researcher:

Proposition 4 (P_4): Successful technology adoption is a major factor in transitioning the industry to the 4th Industrial Revolution.

The statement is true as since other processes/ dimensions are also at play for an organisation to successfully transform towards the 4th Industrial Revolution. Technology adoption is one of those key processes or dimensions.

Fourth industrial revolution customised framework

The South African OOH advertising industry requires a tailor-made model to successfully transform towards the 4IR era. To achieve this, multiple factors need to be considered before and during an organisation's transformative journey. This involves taking note of the actors within the industry, the state of play of the industry, the proper

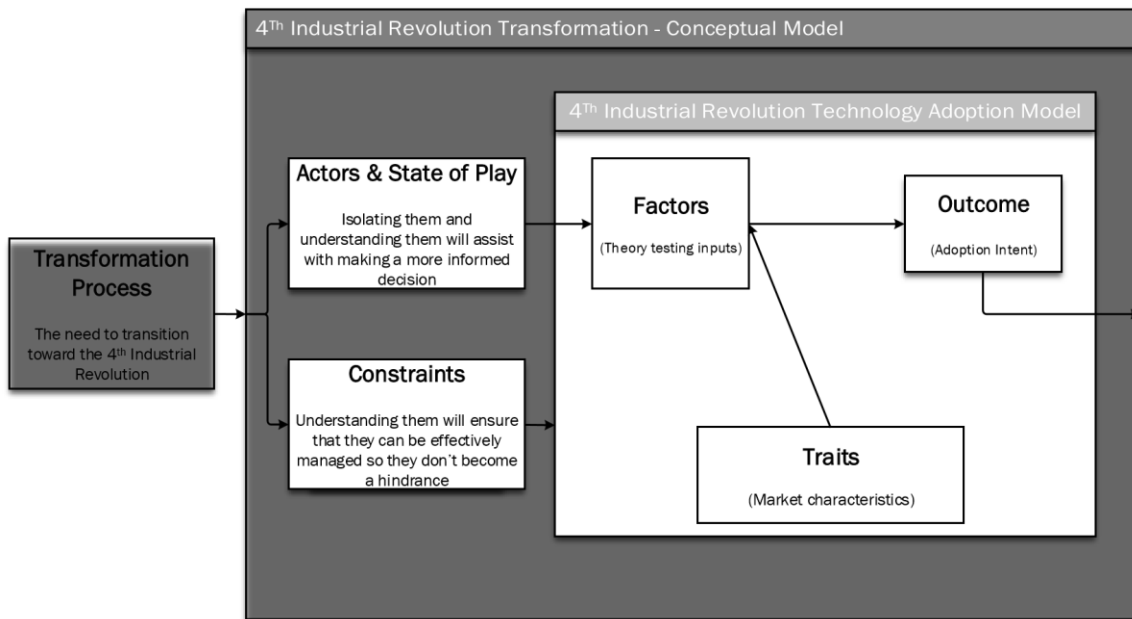


Figure 6. Fourth Industrial Revolution transformation conceptual model.

management of constraints present within the industry and the technology adoption model to be used. The research question that relates to the process of the 4th Industrial Revolution transformation is stipulated as: Research Question 3 (RQ3): How will the South African OOH advertising industry go about transitioning towards the 4th Industrial Revolution?

The 4IR transformation process should always commence with the industry acknowledging that the shift is necessary. What also needs to be acknowledged is that without the shift, the industry would be in danger of reaching stagnation in growth. Figure 6 depicts an overview of the main sub-concepts together with their

correlations on how the South African OOH advertising organisations can go about transitioning towards the 4IR. With Figure 6 as the base in addressing the posed research question, the step-by-step approach that the South African OOH advertising industry should take to successfully transition towards the 4th Industrial Revolution is stipulated as:

Step 1: Before embarking on the transformation process. Investigate and note all the actors/stakeholders that should form part of the process.

Step 2: Do an analysis of the current state of the industry. Analyse as many variables as possible that concern the industry so as to make well informed decisions before and during the 4th Industrial Revolution transformation process.

Step 3: With input from all actors/stakeholders create a plan that considers their interests.

Step 4: Identify as many potential constraints/issues as possible which could become a hindrance during the 4th Industrial Revolution transformation process.

Step 5: Once these constraints have been identified, address as many of them as possible and mitigate those that can't be eliminated to not have them disrupt the 4IR technology adoption process

Step 6: Taking note of the state of play of the industry and using feedback from the actors. Determine the technology adoption factors that should form part of the study together with their measurement criteria.

Step 7: Use the market characteristics which comprise the Industry, Product, Geographical and Company characteristics to assess the impact they have on the technology adoption factors and make the necessary adjustments.

Step 8: Adopt said technologies based on findings from Step 1 to Step 7

Step 9: Start the 4th Industrial Revolution transformation process again. That is people, innovation, strategy, leadership and back again to technology adoption.

Conclusion

Owing to the lack of research having been conducted on the transformation of the South African OOH advertising industry towards the 4th Industrial Revolution and the assumption that the industry has not transformed. It was prudent for a customised framework to be developed while taking into consideration the nuances of a country such as South Africa.

Before embarking on the 4IR transformative process, one needs to first take note of all the actors that could have an impact on the process and the state of play of the industry. Doing so ensures actors do not become an obstacle but more of a resource that can be leveraged. Further to that, understanding the state of the industry helps with decision making. The study also aimed to investigate the constraints that could potentially hinder the successful adoption of emerging technologies. The overarching theme that emerged was that a concerted effort was required to either eliminate or mitigate the risks of the constraints.

While market characteristics impact technology adoption factors, it is the technology adoption factors that influence the behavioural intention of organisations on whether to adopt technologies. Transitioning towards the 4th Industrial Revolution does not only require technology adoption but also people, innovation, leadership, strategy and process. Study participants overwhelmingly agreed that all six dimensions form the bedrock of 4IR transformation process.

The study's broader objective was to build a customised framework for the South African OOH advertising industry in transitioning towards the 4th Industrial Revolution. The framework developed could however be reconfigured to suit another industry owing to it being underpinned by technology adoption theory in its broader

context. The study also serves to enhance the body of knowledge related to technology adoption within the industry.

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