On Par with Digital Transformation

An adapted model for assessing digitisation within the golf ecosystem, substantiated through empirical evidence involving ongoing digital transformation surrounding golf courses in the Netherlands

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Statement of originality

I, M.T. van der Weide, hereby assert full responsibility and authorship for the contents of this paper. The work presented is entirely original and I affirm that no sources beyond those explicitly cited within the text and its corresponding references have contributed to its creation. Generative Text AI solutions have not been utilised beyond reasonable bounds that could otherwise be achieved via conventional search engines. Utrecht University and its faculty members are responsible solely for the supervision of the process.

Glossary of terms

Throughout this research, the term "golf course" is used interchangeably with "golf club", “club” or “course”, unless explicitly stated otherwise.

This research employs abstract understandings of unconventional concepts that necessitate precise definition in order to have a correct interpretation whilst reviewing the findings and research design. The elucidation of these definitions is derived from pertinent references or empirical findings and will be expounded upon in subsequent sections. For the sake of clarity, they are preliminarily outlined here:

Ecosystem: A collection of loosely connected networks of entities, jointly creating value through interdependent interactions.
Entity: Any active value-bringing participant in an ecosystem.

Abstract

An overview detailing research contributions, methodology, findings and implications within an academic context for researchers.

Digital transformation is an important and integral part of the digital shift we as a society are facing. As society is changing to a more digital enhanced version, so are the sports that are played within the society. Golf is no exception to this digital transformation and yet is behind both the actual transition to a digital future and the assessment of the progress. The central organisation within golf could find difficulty in assessing digital transformation within golf. This research proposes the idea that golf is an ecosystem, existing of value bringing entities and the customers within golf. Using two literature reviews, this research uncovers what makes a good method to assess digital transformation and finds the definitions for entities and ecosystems to be used by both researchers and stakeholders. Changes to the model and model process by Westerman et al. (2014) were made to create the *Ecosystemic Digital Technology Transformation Model*. This research then formulates two questionnaires and adapts the model to create the *Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem*. Empirical evidence of an applied version of this model is uncovered by sending the questionnaires to golf courses and golfers. The responses lead to the successful placement of golf courses on the model and therefore the validation of both questionnaires and the model. The proposed altered model can be used by central organisations within ecosystems to assess the digital transformation within the ecosystem. Researchers can use this research to further understand digital transformation within ecosystems.

Model application

An overview of the usage from the results framed within a business context for stakeholders.

This research resulted in a model to assess the rate and range of digital transformation within the Dutch golf ecosystem: *Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem*.

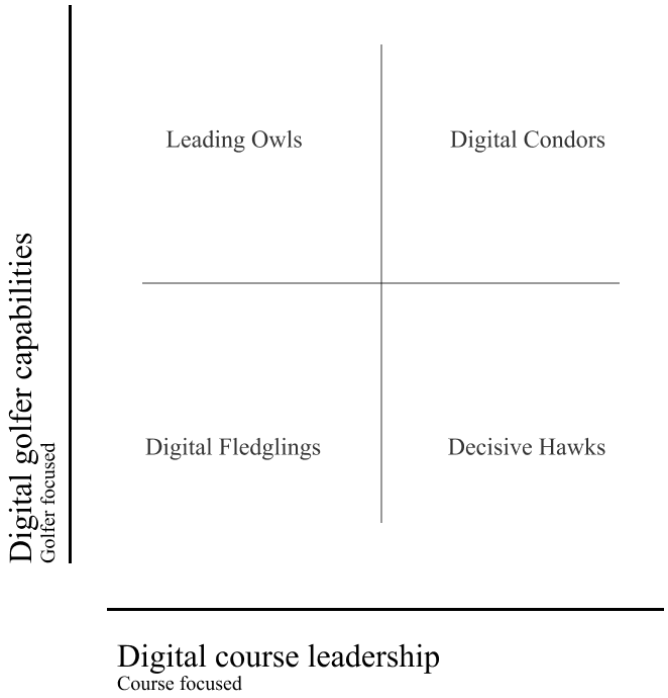

Figure 1: Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

The model, as shown in Figure 1, can be used to plot golf courses on. A golf course should fill out a questionnaire provided in Appendix C. Every plotting question of this questionnaire, identifiable by the Plotting label, results in a score ranging from one (Strongly Disagree) to seven (Strongly Agree). Adding the scores of these seven plotting questions together will result in the digital course leadership score for this particular golf course. This is also the placement of the course on the X-axis of the model, which ranges from seven to fifty-six. Parallel to this questionnaire, the members of the golf course should fill out the questionnaire provided in Appendix B. There are ten total plotting questions for the golfer to fill out. First, a question about what steps they encounter during a phase in their golf journey is asked. The golfer can provide the steps they encounter. That question is followed by a question on how many of those steps are supported by digital technologies. This is done five times in total. The ratio percentage between

the number of steps and the amount of those steps supported by digital technologies is the golfer's digital golfer capabilities score. The average of all the members results in the placement of the golf course on the Y-axis, which ranges from zero to one hundred. The golf course is now plotted on the model and can be compared to other golf courses or a previous assessment.

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In every nook and cranny of life, new interesting, loving and caring people are there to find, meet and understand. Even though the process of writing a thesis is often described as a solitary act, I can honestly say I've met some of the most impressive and interesting people during my research.

Most importantly, I want to express my sincerest gratitude and my thanks to my first supervisor, ***Nico Brand****. His academic knowledge, understanding of research, enthusiasm, kindness and yet thoroughness are all amazing characteristics to have in a supervisor. His ability to remain positive and calm, and to help others feel the same, is truly admirable and worth learning from. Thank you.*
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- *Max van der Weide*

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1 Introduction

1.1 Motivation and context

1.1.1 Digital shift

As a society, we have gone through a digital shift in technology over the last twenty years, seeing a more digitally connected and supported landscape rather than a focus on individuality and craft (Schmidt, 2020). Most aspects of life underwent a great digital shift, seeing a greater and more rapid adoption of new advances in the realm of digital technology. Digital technologies are also becoming increasingly complicated and interconnected (Wolff, 2021). Every aspect of our day to day lives are connected and interconnected with devices and systems, mostly increasing the ease of mundane tasks but also alienating those who are less likely to understand or adopt these general developments in the use cases of digital technology (van Dijk, 2006). Digital transformation is a complex event that influences multiple entities, not identified as a simple or linear process but rather an interactive and dynamic shift that is affected by many entities (Nadkarni & Prügl, 2021). A single individual is not the sole cause of digital transformation, nor is it the sole recipient of the effects of digital transformation. An individual is merely an entity, part of a larger ecosystem that shapes, and is shaped by, digital transformation (Nadkarni & Prügl, 2021). However, whilst this digital shift could be received as the cause for individual turmoil, the rate at which this evolution has conspired was not down to the individual, but rather experienced by an ecosystem. Ecosystems are an aggregation of entities, each making their own choices and decisions, and existing as a separate entity. It is the sequential conglomeration of these individual decisions that start a shift to a digital society, rather than a single entity that forces the entire ecosystem into this shift.

1.1.2 Ecosystems and entities

This research revolves around ecosystems and entities. To form a concise definition, these terms will be explored here. A thorough definition based on research will follow later as the secondary research questions are unfolded.

Society at the forefront consists of individuals, each with their own traits and goals. Multiple individuals can create organised functions that pertain to a certain goal, otherwise known as organisations. Organisations can work with each other and individuals to complete certain

objectives. The collective of these organisations and individuals in this research are referred to as ecosystems. Borrowed from the biological definition of an ecosystem, where Teixeira and Fernandes (2020) define an ecosystem as a dynamic complex of plant, animal and micro-organism communities and their nonliving environment interacting as a functional unit, an ecosystem for this research is defined as a multifaceted and dynamic cluster of interconnected entities, collaboratively functioning within a unified element, exhibiting synergistic interactions aimed at achieving a common objective. An example of an ecosystem is the combination of governmental bodies pertaining to aviation, the aviation industry and travellers who use the services within aviation. An individual who flies with an aeroplane to their destination, an airline facilitating individuals in their travel, an aircraft manufacturer creating and maintaining aircraft for airlines, an airport facilitating those aircraft and their corresponding airlines in their operations, these are all entities that make up the aviation ecosystem. The key difference between an industry and an ecosystem here, is that within an ecosystem, the users, customers or consumers are not outside of the scope, but are instead major components. Entities within an ecosystem are all objects possessing unique and autonomous existence. An entity can be formed by aggregating other entities but could also exist independently. To expand upon the aviation ecosystem example: An airport is an entity within the ecosystem, but the different components within the airport, like air traffic control and facility or security departments, are also all entities within the ecosystem. Just like individuals, organisations can grow in their use of digital technologies. They can come to accept new changes or can see that they are transforming into a new phase of digital technology usage. However, as entities within an ecosystem transform their digital technology, or their digital technology usage, so do the ecosystems that they are a part of. If the gross average of entities within an ecosystem transforms their digital technology, then so will the overall digital technology in the ecosystem. However, if only one single entity is accepting of a new digital phase whilst the others are not, one could say that the ecosystem as a whole is now growing into this new digital technology maturity.

1.1.3 Transformation in sports and golf

Digital transformation within sports has been rising tremendously over the past few years (Petrović et al., 2015). In some sports, the transformation and introduction of technology have fundamentally changed the experience of both playing sports as well as watching them (Petrović

et al., 2015). Take for example the transformation of a centralised worldwide streaming platform for Formula One (F1 TV, n.d.), or field line technologies used in European football (Spitz et al., 2021). Oc and Toker (2022) highlight that the adoption of technology hinges on factors like sports motivation, the nature of the sport and sport context-specific characteristics. In an investigation by Baca and Kornfeind (2006), the use of technologies among fitness enthusiasts was shown. Their study goes into the diverse set of advantages of using digital technology to capture and analyse data. Lames and McGarry (2007) further stress this, by highlighting the role of technology in team performance analysis, focusing on video analysis and computer simulations to make predictions and good assumptions.

Whilst many aspects of modern society and sports might have received major advancements due to the acceptance of novel approaches in the form of these digital developments, one sport could come to mind that is not associated with ever changing environments and a general acceptance of change: Golf. The game of golf has been around since the 15th century, and is still growing to this day (NGF, 2022). A sport almost resilient to change (Ceron-Anaya, 2010), that has seen major developments in the past few years. Just like any change it went through, the game of golf seemed reluctant to adopt technology as a driving force behind further improvement and change. It was not until the global COVID crisis of 2020 that golf courses were forced to start implementing contactless planning methods, to ensure safety for all players (Government of the Netherlands, n.d.). It is this sudden and immediate adoption of technology that sparks the interest for further research. It poses a great case to see how the overall digital transformation of a world that was not let into the realm of technology through natural evolution, but rather forced revolution, occurred and how it has expressed itself into a well-developed digital realm. But as it stands, the Royal Dutch Golf Federation (NGF), in Dutch the Koninklijke Nederlandse Golf Federatie, could have a hard time evaluating the digital transformation within their sport.

Not without its controversies, the United States Golf Association (USGA) announced a new method for testing golf balls, meaning that the distance which professional golfers can hit with a ball will be rolled back (USGA, 2023). The new ruleset, aptly named “Golf ball rollback” has been met with severe judgement and criticism by both professional golfers and amateurs. When asked about this reaction by golfers, the IT architect overseeing the technology at the NGF concurred that the ongoing debate and conservative leanings regarding the suggested golf ball rollback rules reflect golf's inherent resistance to change (Appendix D, 34:49. Full transcript of

the interview is available in out-of-document Appendix “NGF (Voice 007)”), highlighting the sport's overarching aversion to embracing novel approaches. With this reaction to a seemingly unnoticeable change, one could perhaps see a possible sight towards a similar reaction to the introduction of other game changing elements, like adopting digital technologies in and around the game of golf. Golf is considered an old and conservative sport that seeks its foundation and reason of existence in the social gatherings and aspects it creates (Ceron-Anaya, 2010). Because of the inherent social character of the sport, it puts golf directly opposed to the more individual and self-centred nature of the developing society which is supported by technology (Royakkers et al., 2018). With developments that could lead to a decrease in player-to-player interactions and time spent waiting to play, it might look at an ever-changing landscape that does not facilitate this part of the game. Feliscuzo et al. (2011) found that age affects the impact of the considerations of usage intention and behaviour. According to the NGF, more than half of Dutch registered golfers are older than fifty-five years old (NGF, 2021). Considering these two factors, it seems like a great case to see how the world of golf has adapted to these sudden changes, and how it has been willing to change. It is the combination of the sudden integration of digital technologies and the average age demographic of the game of golf that sparks interest in a study in the overall digital transformation rate and arguments of the game.

In October of 2021, the announcement of a new golf league was made (USA Today, 2023). Next to existing leagues in the likes of the PGA Tour and the PGA European Tour, currently named the DP World Tour, a new tour backed by the Saudi Arabian owned Public Investment Fund would be created: LIV Golf. The announcement and subsequent “poaching” of players from other tours was met with severe controversy (Golf Monthly, 2023). Not only because the Saudi Arabian government was heavily involved, or the tournament was actively recruiting players from other tours by offering them incredibly high signing bonuses and financial promises, LIV Golf also promised to change the game of golf and how tournaments were to be played. Not only does LIV Golf lack a “cut” system where players outside a certain range will not receive any money from the available purse, they also set up their live broadcasting services in a modern and digital accepting manner (LIV Golf, 2022). So much so, that their tournament in Australia was awarded World’s Best Golf Innovation by World Golf Awards in 2023 (LIV Golf, 2023), recognising their effort to modernise and digitise the game of golf, the tournaments and the broadcasting to fans.

1.1.4 Digital transformation and NGF

Many organisations realise that they need to digitise their processes and be accepting of digital transformation (von Leipzig et al., 2017). They also recognise their difficulty in reviewing and apprehending the starting point of their digital endeavour. Organisations have access to models that can be used to support efforts in identifying the state and range of digital transformation (Nadkarni & Prügl, 2021; Bellantuono et al., 2021). These models are detrimental to the review process of an organisation's digital transformation and the transition to a more digital focused structure.

Where the sporting industry started to adapt to a digital landscape heavily in the 2010s (Schmidt, 2020), "Golf has only just adapted to many digital changes over the past few years" as is suggested by the IT architect of NGF (Appendix D, 01:01. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)).

The increase of technology use in sports (Schmidt, 2020), and the sudden integration of digital technologies in the world of golf, opens a door to an extensive analysis of the overall adoption of digital technology in the world of golf, how it differs compared to other sports and what to achieve to mitigate the negative effects of this development. As it stands, there is no clear way to view the state of the current digital shift within an ecosystem. Golf could therefore be a great case to test a model to view this digital shift with, because of the late digital transformation and possible need for such a model. Also, the NGF might have a clear problem in that they could have a hard time knowing the current digital transformation state of their sport. This problem will be further examined in chapter 1.2.

The NGF is a decentralised association, meaning that the NGF is not the executive of the ecosystem. Their existence is merely a supporting, sometimes even only an administrative role, and other entities within the ecosystem are encouraged and involved by the NGF to make decisions about the evolution of the ecosystem. The distinction of a centralised or decentralised association within an ecosystem is taken from a centralised or decentralised corporate structure, where the executives make direct decisions or implore others to make those decisions respectively (Cosh et al., 2012). Golf is already showing to go through a digital shift, and a transformation as a whole, but where the NGF is a decentralised organisation, research supports that a centralised organisation is better in times where an organisation needs to adapt to change

(Alonso et al., 2012). Centralised organisations tend to have tight boundary controls and more informal interactive controls (Herbert, 2009).

Digital transformation and the understanding and mapping of one's rate and range of digital transformation, are vital to an organisation's ability to survive and thrive in a digital age. Many organisations hesitate to accept digital transformation due to perceived risks and lack of experience, even though digital transformation has transformed entire industries (Stark, 2020).

1.2 Problem statement

Whilst most modern models and frameworks are mature options that are tested profoundly by the scientific and commercial communities, they lack a common requirement that cannot be improvised by an immediate and short-term change in the model: looking at the digital transformation of an entire ecosystem. Whilst preparing this research, no references were found that supported or introduced a model, method or framework that could reliably assess and review the rate and range of digital transformation within an ecosystem, nor did any research support the use of existing models, methods or frameworks to assess and review the rate and range of digital transformation for entire industries.

An entity lacks the inherent ability to efficiently and effectively assess digital transformation within an ecosystem. Whilst separate entities, regardless of size or importance, within an ecosystem can be tested on their level and range of digitisation, there is no single clear and concise model to use when reviewing the digital transformation of an entire ecosystem. Without such a model, entities cannot assess the current and upcoming stages of digital transformation within the ecosystem, which could result in uninformed decisions. Whilst one entity can be on the forefront of digital transformation, the ecosystem as a whole might still be behind on the general and common level of digital transformation that is experienced in other ecosystems.

It is crucial for any governing entity within an ecosystem, or any entity seeking to influence that ecosystem, to understand the current state of digital transformation within the ecosystem they are associated with or wish to influence. Without a good overview of the current state of the digital transformation of an ecosystem, one cannot act in a well-informed manner, nor can a direction be given to the entire ecosystem.

Next to the lack of an inherent ability to efficiently and effectively assess digital transformation within an ecosystem, researchers are missing a model to do the same. There is no clear and concise model to use that can assess the digital transformation of an entire ecosystem.

The solution to the problem statement will result in an altered model with which one can better evaluate the rate and range of the current level of digital transformation within an ecosystem allowing for better execution of digital shifts and phases, and a more educated leap when making decisions and taking action. The primary scientific contribution lies in the formulation of a model, designed to assess the state of digital transformation within an entire ecosystem rather than the rate and range of digital technologies for single entities, which can be used in future research.

The generic problem statement can be defined as:

"There exists a lack of an inherent ability to efficiently and effectively assess digital transformation within an ecosystem".

The solution that could resolve the generic problem statement could apply to a real situation, namely the NGF in the golf ecosystem. The problem statement is therefore changed to aptly fit to that situation. The NGF lacks the inherent ability to efficiently and effectively assess digital transformation within the golf ecosystem. Whilst separate entities, regardless of size or importance, within the golf ecosystem can be tested on their level and range of digitisation, there is no single clear and concise model to use when reviewing the digital transformation of the entire golf ecosystem. Lacking such a model, the NGF cannot evaluate the current and coming phases in the progression of digital transformation for the golf ecosystem, which in turn might lead to uneducated commitments. Without knowing the state of digitalisation, one cannot make correct decisions in what direction one should move. Moreover, if the NGF wants to have an option available to move to a more centralised association rather than a decentralised association, being well informed on the current state of the ecosystem they are trying to manage could result in a more thriving future and an easier job in convincing others within the ecosystem.

The more tightly scoped practical problem statement for this research's specific requirements can be defined as:

"The NGF lacks the inherent ability to efficiently and effectively assess digital transformation within the golf ecosystem".

1.3 Research questions

1.3.1 Primary research question

"How can the governing body in the golf ecosystem assess digital transformation of that ecosystem?".

1.3.2 Secondary research questions

1. "How is digital transformation assessed?"
2. "What are ecosystems, entities and centralisation?"
3. "What are the characteristics of the golf ecosystem?"
4. "How is digital transformation in the golf ecosystem assessed?"
5. "How is an ecosystemic digital transformation assessment model for the golf ecosystem used in practice?"

1.3.3 Applied research methods

This research applies various research methods to ascertain the solution or answer to the secondary research questions before answering the primary research question. The applied research methods will be explored in this chapter.

[1] A literature review in this research will be conducted through a devised set of steps, based on the work of Teichert (2019), who conducts a systematic review of literature for the realm of digital transformation maturity and uses the procedures for performing systematic reviews for software engineering research by Kitchenham (2004). Some changes to these examples and procedures might occur but are then outlined and expounded clearly in the corresponding secondary research question. A backward snowballing technique will be utilised, where new papers will be identified by looking at the reference list of a set of papers and matching them to criteria (Wohlin, 2014). After a thorough examination of each paper, themes are extracted by matching the theory at hand in the selected secondary research question, and the explanations within the paper surrounding that same matter. Just like the method from Hodge (2018) states, an emphasis is put on the qualitative statements from the authors themselves: conclusions, insights and interesting thoughts pertaining to the matter at hand. These themes are

then aggregated and used to answer the secondary research question that is discussed, whilst citing the corresponding papers.

[2] Semi structured interviews will be held with various stakeholders, ecosystem experts and entities to answer the secondary research question following the guidance report by Roberts (2020). If the researcher finds the set of questions to not fit the representative or situation, they are able to convert to an unstructured interview in favour of the research and results. The interview starts with a grand tour question (Roberts, 2020) that will allow for a placement of the participant within the ecosystem to be made: “Could you describe your place and role in the Dutch golf market in detail?”. Their answer will allow for any follow-up questions if necessary, depending on the depth of their answer. The next question would revolve around their role in digital technology innovation: “What role do you have in the digital technology innovation within the Dutch golf market?”. Their answer will again allow for any follow-up questions if necessary, depending on the depth of their answer. Then, a question will be asked about their view of the current state of digital technology: “What digital technologies do you currently see being employed in the Dutch golf market?”. Their answer will again allow for any follow-up questions if necessary, depending on the depth of their answer. Then, a question will be asked concerning the future innovations: “What innovations do you expect to thrive in the coming years within the Dutch golf market?”. Their answer will again allow for any follow-up questions if necessary, depending on the depth of their answer. The answers to the questions, and any open follow-up questions, will provide the following knowledge: The participant’s placement within the Dutch golf market, their role in the digital technology innovation for the Dutch golf market, their perception of current digital technologies within the Dutch golf market and their perception of future digital technologies within the Dutch golf market. The list of stakeholders to be contacted is to be created with the help of the NGF, as they are likely to understand the most important stakeholders in the Dutch golf ecosystem.

[3] Secondary analysis of qualitative data refers to the methodology of reusing pre-existing qualitative data from previous research (Heaton, 2008). Secondary analysis in this research is understood as the process of compiling existing data, results and findings sourced from sources within other secondary research questions, or sources that came up because of other secondary research questions, to answer the secondary research question at hand.

[4] The validation process of this research is a case study that pertains to the applicability of the produced methodology to find the digital transformation within an ecosystem. A set of questionnaires will be sent out to golfers and golf clubs and courses in the Dutch golf ecosystem. A list of golf courses and clubs will be created that can fortify the results by having their selection of representatives and golfers fill out the questionnaires. The quantified responses, matched with the place of their response relative to others, will result in a filled in model that can be reproduced within the same ecosystem.

1.3.4 Methodology

#	**Secondary research question**	**Research method**	**Procedure**	**Applied research method(s)**, *listed in 1.3.3*
1	“How is digital transformation assessed?”	Literature review	Keyword searching, backward snowballing and thematic saving	1
2	“What are ecosystems, entities and centralisation?”	Literature review	Keyword searching, backward snowballing and thematic saving	1
3	“What are the characteristics of the golf ecosystem?”	Interviews	Semi-structured interviews	2
4	"How is digital transformation in the golf ecosystem assessed?"	Secondary analysis	Analyse data, results and findings from previous secondary research questions	3
5	“How is an ecosystemic digital transformation assessment model for the golf ecosystem used in practice?”	Case study, Validation	Survey/questionnaire Documentation	4

Table 1: Methodology per Secondary research question (Listed in 1.3.2)

Table 1 specifies the secondary research questions and the methodology. In short, the proposed research will be executed in the following steps:

First, digital transformation and its assessment is explored. Second, the definitions used in this research will be explored and defined. Third, interviews will be held with key players in the

Dutch golf ecosystem, to get a sense of its characteristics. Fourth, results found prior to the fourth secondary research question will be used to explore a model that will be adapted to fit the Dutch golf ecosystem. The research conducted will propose a model, created from an altered existing model or a congregation of models to better fit the golf ecosystem, which can then be tested on the actual ecosystem. Golf courses will be plotted upon the proposed altered model by aligning their various digital and leadership capabilities with a score based on their answers to predefined questions. The score of digital transformation within an ecosystem is then based upon the congregated scores of the golf courses. This can then be used by the NGF to assess and understand digital transformation within the golf ecosystem in the Netherlands.

1.3.5 Secondary research question relationships

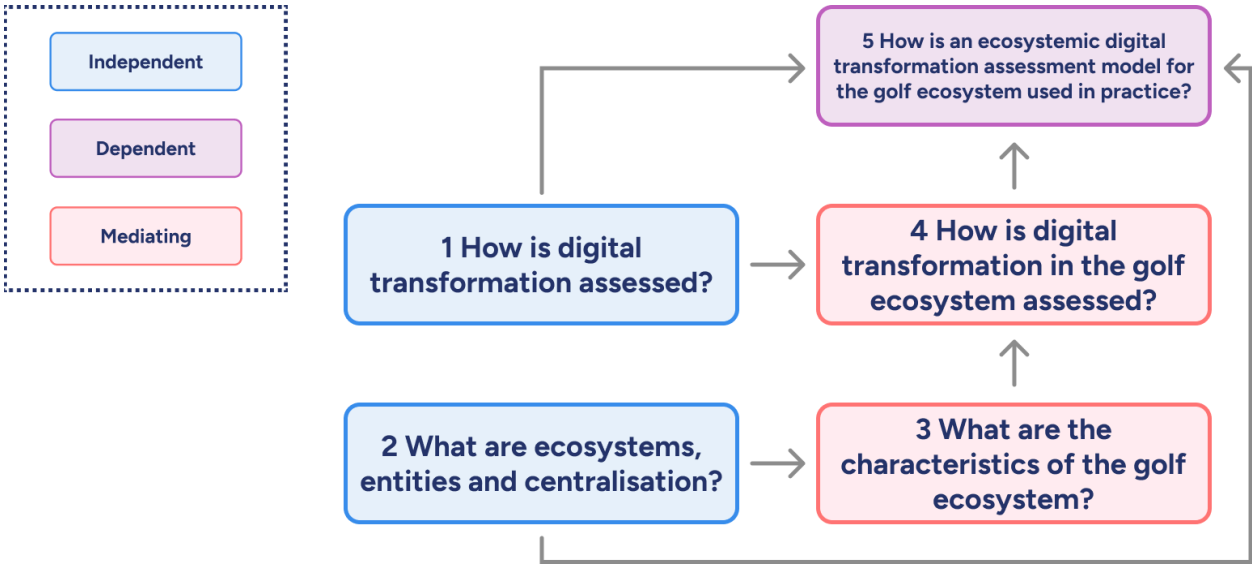

Figure 2: Secondary research question relationships

Secondary research question relationships, as seen in Figure 2, show the relationships between the research questions as listed in 1.3.2. It starts with the first secondary research question, which is independent; it is a question that can be answered without influences from other research questions. The same goes for the second secondary research question. The third secondary research question is mediating between the second secondary research question and the fourth. The fourth secondary research question is influenced by the third and first secondary research questions. The fifth secondary research question is influenced by the fourth secondary research question, the second secondary research question and the first secondary research question.

Eventually, all these secondary research questions make up the answer to the primary research question.

An important note to the structure of this research is the progressive structure; secondary research questions build upon each other to complete or answer the primary research question. Some secondary research questions might therefore not directly relate to the subject of the research but do help in building up to the results and conclusion by supporting other research questions. Refer to this chapter and Figure 2 when reviewing the documentation of this research.

1.3.6 Conceptual framework

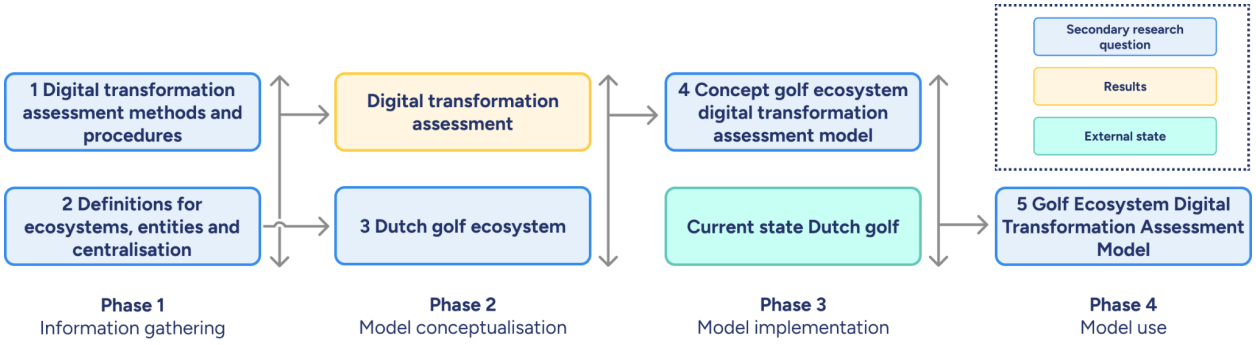

Figure 3: Conceptual research model

The conceptual research model, as seen in Figure 3, shows the relationships between the research questions as listed in 1.3.2 by the design guidelines of Verschuren & Doorewaard (2007). Phase one starts with the information gathering, answering the first secondary research question: "How is digital transformation assessed?" with digital transformation characteristics, and the second secondary research question: "What are ecosystems, entities and centralisation?" with definitions for ecosystems, entities and centralisation. The first secondary research question and second secondary research question are used to answer the third secondary research question in phase two of model conceptualisation with a result of understanding of digital transformation characteristics and ecosystem knowledge about the Dutch golf ecosystem. Only the second secondary research question is used to answer the third secondary research question: "What are the characteristics of the golf ecosystem?" which ends up with an overview of characteristics of the Dutch golf ecosystem. The third secondary research question and the digital transformation characteristics are used to answer the fourth secondary research question in phase three of model

implementation: "How is digital transformation in the golf ecosystem assessed?" which results in the concept of the model for this research. This is compared to the current state of Dutch golf, which results in the answer to the fifth secondary research question in phase four of the model use: “How is an ecosystemic digital transformation assessment model for the golf ecosystem used in practice?”.

1.3.7 Ethics and Privacy Quick Scan

The Ethics and Privacy Quick Scan of the Utrecht University Research Institute of Information and Computing Sciences was conducted (Appendix A).
It classified this research as low risk with no fuller ethics review or privacy assessment required.

1.4 Contributions

1.4.1 Society

Allowing the NGF to better evaluate the rate and range of the current level of digital transformation within an ecosystem allows for better execution of digital shifts and phases, and a more educated leap when making decisions and taking action. A model of this capacity allows the NGF to efficiently and effectively align their business goals with the current state of various ecosystems. It can also help golf courses assess their own position of digital transformation within the golf ecosystem. The model can motivate the NGF to entertain the idea of certain steps, but it can also withhold them to undertake action when their ecosystem is not ready for digital transformation or not accepting of it as a whole, or when the phase of their digital transformation is not yet on par with the entity’s expectations. This research will create a solution from empirical evidence found in a real situation, namely the NGF in the golf ecosystem. This will allow the NGF to better assess the digital transformation within the golf ecosystem. The research also proposes steps to create such a solution for other ecosystems. However, the proof and ultimate solution will revolve around the problem statement and scope of this research, namely the Dutch golf ecosystem.

1.4.2 Scientific

The primary scientific contribution lies in the formulation of a model, designed to assess the state of digital transformation within the golf ecosystem rather than the rate and range of digital

technologies for single entities, by adapting a model that can be used to assess the digital transformation of golf courses in the Netherlands, and eventually an answer to how one could measure a phenomenon in an ecosystem, how one measures digital transformation in an ecosystem and how one can make measuring digital transformation in a specific ecosystem a concrete set of actions.

The results of this thesis will create empirical evidence, supporting or displaying the absolute impact of the eventual model that can verify or evaluate the current state of digital transformation within the ecosystem. This will add to the existing body of research on technology's influence, contributing to the understanding of its effects. It will also expand the current insights into digital transformation, both on a general level and focused on the golfing industry.

The model developed in this thesis not only contributes to evaluating the state of digital transformation of a number of golf courses at any current time, it also serves as a valuable tool for fostering continuous improvement. By having a clear and concise indication of the imminent phases and allowing golf courses to compare their current state of the digital transformation within their ecosystem to other golf courses in the same ecosystem, can guard the chosen narrative for their decision to pursue a certain digital transformation approach.

1.5 Threats to validity

1.5.1 Internal Validity

Internal validity refers to the extent to which a causal relationship between variables can be established and is not affected by other variables.

Unanticipated events could change the conditions of the study and have an effect on the outcome. For example, a significant technological breakthrough during the research could affect the digital transformation rate and range for the given ecosystem. The passage of time could affect the dependent variable. The digital transformation within an ecosystem might naturally evolve over time, independent of the applied methodologies or models. There is no method to stop the passage of time. However, one could make a snapshot of the situation that is currently the digital transformation in the ecosystem. One could then make claims upon that situation in that place within time without having to worry about the passage of time.

Another threat is making the wrong assumptions and drawing faulty relationships within an ecosystem. A way to make sure that this does not happen, is by collecting and aggregating a lot of information, whilst also fetching and confirming these data and results with industry experts.

1.5.2 External Validity

External validity refers to the extent to which the results of a study can be generalised to other populations, settings and moments in time.
If the entities studied are not representative of the broader population within the given ecosystem, the findings may not be applicable for all entities within the ecosystem, and the result of the model will not be representative of the situation within the ecosystem as a whole. In that case, not the entire ecosystem is tested and only a selected part of it received a verdict. This can be mitigated by first understanding the ecosystem, so that one can validate that an entire part, or the majority or most important part at least, receives a verdict.

1.5.3 Construct Validity

Construct validity refers to the extent to which a measure aligns with established theory and understanding of the concept it seeks to assess.
It is paramount to the generalisability and validity of the results to select an adequate sampling size when making conclusions about the state of the ecosystem at hand. Creating models from a select part of entities within the ecosystem will result in a singular view that affects the conclusion to which the end result will lean. The model itself will also not be created directly by participants of the research, so that the model itself does not need to be understood by a participant in order to fill it in.

1.5.4 Reliability

Reliability refers to the consistency and stability of the measurement tools used in a study.
A measurement of some sort will take place during any part of this research. Measuring the wrong data or completing the measurement in the wrong way will result in a threat to the reliability of the research and its findings. Because the researcher at hand is also a part of the ecosystem to be reviewed, one could argue that observer bias also comes into play. Another researcher can validate the independent results by repeating the research process and finding the

same results. By creating clear and concise steps within the research process, and by documenting the entire process, one can make sure that another researcher can go through the exact same steps whilst validating the findings.

1.6 Thesis context and timeline

Towards the end of June, or the beginning of July of 2024, a solution will be presented that can be used to evaluate the current situation of digital transformation for an entire ecosystem, in the case of this research the Dutch golf ecosystem. This solution is created based on data and existing knowledge in modelling for technology and technology transformation and adapted to entire ecosystems and specified to digital technology. Before the solution can be tested in a real-world situation, knowledge in the form of literature review needs to be gained in order to make well-informed decisions concerning the design and structure of the solution. Just before the research can take place, a long proposal is presented to grade the validity and the feasibility of this thesis and subsequent research project.

The research is performed by M.T. (Max) van der Weide, student Business Informatics at University Utrecht. The first supervisor is lecturer Drs. N.A. (Nico) Brand. The second supervisor is assistant professor Dr. I.M. (Iris) Beerepoot.

1.7 Research scope

This research will revolve around the creation and testing of a model that can help assess digital transformation in a certain ecosystem. The ecosystem chosen to be used is the Dutch golf ecosystem. The research and eventual model will work for that ecosystem. It should be possible to create the same functionality in a model using this research in the future for a different ecosystem. Some changes could have to happen before it works or fits the ecosystem.

The problem statement or scope of this research does not revolve around research about centralising ecosystems. The solution that this research will provide will not be specific to centralised or decentralised ecosystems or models. Centralisation in this research speaks solely to the decision-making powers and structure of the governing body within the specified ecosystem, namely the NGF in the golf ecosystem.

A case study will be used to validate the created model.

2 Theoretical Framework

2.1 The sport of golf

Golf is a precision sport played with clubs (equipment) and a golf ball where players aim to hit a small ball into a series of holes on a grass course (USGA, n.d.). Their objective can vary across multiple versions of the game, but it is mostly centred around having to score as low as possible by hitting the ball as little as possible. The grass courses typically consist of 18 holes, each having a different layout with obstructions like trees and water (USGA, n.d.). A golf course can also have more or less holes, but the game is mostly centred around a full round of 18 holes. Depending on the version players are participating in, they can play alone against the course, or in teams (USGA, n.d.). A player uses a golf club (equipment) to hit the ball and is never required to directly displace the ball themselves in normal play. The amount of golf clubs (equipment) a player brings can vary from player to player, but a bag of clubs (equipment) typically consists of woods for longer distances, long, mid and short irons and a putter for the last part of a hole. A hole starts with a tee shot, where players hit the ball from a designated area called the tee box towards the fairway, the carefully manicured strip of grass leading to the green (NGF, n.d.). Subsequent shots aim to progress the ball closer to the hole, navigating obstacles like bunkers, rough and water hazards along the way. Players then come up to the green, where they use the putter to roll their ball into the hole. This completes the hole, and players can continue to the next hole. Depending on the version of the game they are playing, they write their total score or relative score on a scorecard (NGF, n.d.). This scorecard is later signed by another person in their group, after which it is either filled in online or returned to the clubhouse where it is deposited to be entered in a score system by someone from the clubhouse (NGF, n.d.). Golf is played at a golf course or golf club (NGF, n.d.).

Central to golf is the concept of the handicap system which allows players of different skill levels to compete on an equitable basis (USGA, n.d.). Handicaps are numerical representations of a player's skill level, calculated based on past performance relative to the course's difficulty (USGA, n.d.). Depending on the version of the game a group is playing, the score a player hits in a hole is divided between the gross score, the direct score, and the net score, the score they received after the effect of their handicap has been applied (USGA, n.d.).

A hole in golf has an associated par scoring, meant to be the score per hole a player with a handicap of zero should be able to shoot (Origin and Meaning of Golf Terms - Scottish Golf History, n.d.). A lower score than par is better, a higher score than par is worse, leading to a goal of hitting as few shots as possible.

Golf scoring has terms associated with birds (Origin and Meaning of Golf Terms - Scottish Golf History, n.d.). Birdie, Eagle, Albatross and Condor are all used for a score of minus one, minus two, minus three and minus four respectively.

Looking into the history of golf, the transformation of a regular pastime activity one could enjoy to a sport mainly associated with upper to middle classes is noted, with the combination of the formalisation of rules of etiquette and the introduction of the handicap that played an important role into changing it to an actual sport one could excel in (Ceron-Anaya, 2010). History reveals that this notion of fair play and self-improvement were attractors for the upper-middle social sectors (Ceron-Anaya, 2010). The high cost of starting golf and the introduction of member exclusive golf clubs contributed even more to the social status that was synonymous with golf and its atmosphere (Ceron-Anaya, 2010). This foundation of status, mostly in social form, was the starting point for seeing golfing as a social activity, shaping the social dynamics for the sport (Ceron-Anaya, 2010). This social aspect extended beyond the confines of the sport of golf and gained attraction to those wishing to conduct business in a relaxed environment, ready for friendly interactions and fostering a sense of camaraderie among those playing with each other (Ceron-Anaya, 2010). It is also noted that the time it took to play a round could have contributed to this, as a round takes enough time to conduct business and close deals (Ceron-Anaya, 2010). The addition of a clubhouse where socialising after the sport was also attributed to the already abundance of social interactions (Ceron-Anaya, 2010).

2.2 Technology in golf

According to Liebermann et al. (2002), numerous digital technologies have already been introduced in the realm of sports. Virtual environments, computer-aided sport analysis, force platforms and tracking and video technology are all being used by athletes and recreational players of various sports, but also by governing associations and broadcasters. The infographic of Digital Sport (2014) shows the technology progression for line technology systems within the realm of sports. In 1991, the IBM Radar was first used at Wimbledon for tracking ball speed

during a tennis match. Ten years later, in 2001, Channel 4 used Hawk-Eye, a system to see if a ball is in or out of court, for cricket. In 2005, FIFA adopted the +Teamgeist 2 system for the World Championship, which can track the ball's location at all times. The PGA Tour only started using tracking capabilities for every golf shot during broadcasting in 2022 (PGA Tour, n.d.), previously only tracking certain shots and conditions, even though a ball tracking system for broadcasting has been available since 2006 (Toptracer, n.d.).

Rubel et al. (2014) found that solutions in the form of new technologies had been developed, aiming to enhance a golfer's playing experience. They list a few new innovations, like the use of Global Positioning Systems (GPS) or Radio Frequency Identification (RFID) in location and ball tracking, tee time planning methods and hotel reservation systems. They conducted research in 2014 to conclude if a course should invest in new technologies in order to retain current players associated with the course. Their research did not result in a concise answer that could justify the spending a course should do in order to innovate their technologies, as they could not see a correlation between a course's technologies and the number of current players that would like to retain at the course. Rubel et al. (2014) found that in 2012, only 14% of all tee time bookings were done in phone-based planning systems. They state: "These lack luster results may be an indicator that golfers do not value the inclusion of technology at the course level.". Lee (2021) wrote a master thesis about the perceived value of a direct booking website for golfers, using the UTAUT 2 model, and concluded that "golfers have positive perceptions of a direct booking website and their expectations are related to benefits, ease of use, social interactions, and entertainment features.". The difference between these two findings, considering their publish date, might point to a better acceptance of technology surrounding the game of golf.

The NGF has developed a reservation platform in cooperation with the Nederlandse Vereniging van Golfaccommodaties (NVG), called GOLFGO (NGF, n.d.-b). GOLFGO allows Dutch golfers to reserve tee times at 70 participating golf courses. Since the launch in 2020, an average of 80,000 tee time reservations have been made.

A golf industry trends report from Lightspeed (2023) found that more than half of their survey respondents preferred online tee time booking methods over in-shop or phone tee time reservation. They also found that 18% of their respondents factor in the access and addition of modern technologies in and surrounding the golf course when making their decision to visit a course or not.

The use of digital technologies within elite golf, by both clubs and players, is now readily available (Mears et al., 2019). According to Leach et al. (2017), golf clubs employ digital technologies in various ways. According to their research, golf clubs have introduced launch monitors that are able to offer instantaneous methods to measure clubhead and ball impact parameters, which are valuable to various implementers like coaches, golfers, club-fitters and equipment manufacturers. Golf clubs also implemented systems for motion analysis that can be used to track the clubhead and ball in a dimensional mapping, which can provide more detailed information on the performance outcomes and biomechanics of the golf swing. Leach et al. (2017) also mention various other technologies, such as optical sensors, oscilloscopes and custom-built devices.

In a trend report about the use of technology and digital innovations for golf by the NGF in 2023, numerous expected and currently expanding innovations to the realm of golf are listed (NGF, 2023). The NGF mentions in this report the expanded availability and use of data analytics by golf clubs and golf courses, and that many golf course maintainers are readily working with a Geographic Information System (GIS) to create digital maps of the entire course with which both players and maintainers can stay informed on the layout and structure of the entire area (NGF, 2023). NGF uses the report to inform that new scanning equipment will be used to aid in the grading of the course rating, used to determine how difficult a course is (NGF, 2023). The report actually states that more quality assurance equipment will be used in the coming time, which could be implemented by adapting agricultural equipment (NGF, 2023). This new equipment, and the existing equipment used for course upkeep, could also see a new phase with the introduction of AI and self-driving vehicles (NGF, 2023). The report also goes over digital media and facilities that golf clubs can implement to further enhance the experience of members, like self-check-in and new communication methods, or digital course status signs that can automatically update depending on the conditions at the course (NGF, 2023). The report also mentions trends on the side of tracking and assessment, expounding the use of sensor focused golf balls, on-course player tracking and golf swing analysis tooling (NGF, 2023). The report further stresses that many players still use traditional methods to make tee time reservations, by going to a course in-person or calling before their round, but it does also mention that younger players are seen to use digital technologies to make reservations far more (NGF, 2023).

The most substantial innovation that the trend report of the NGF (2023) mentions is the development and introduction of gamification solutions in the realm of golf. An example of gamification outside of the conventional game within a golf course is the introduction of driving range game facilities, like Topgolf for the United States of America, and Chi Chi Golf in the Netherlands. These facilities allow for a more informal playstyle, integrating ball tracking technology and an entertainment focused setup (Topgolf, n.d.).

2.3 Leading Digital: Four levels of Digital Mastery

Westerman et al. (2014) state that technology is the biggest story in today's business environment in their book "Leading Digital", bigger than globalisation, bigger than offshoring, bigger than shifting demographics. Bigger, because technology and digitisation is removing constraints and creating new possibilities that affect lives and organisations (Westerman et al., 2014).

Over the span of three years, Westerman, Bonnet and McAfee conducted research on how firms around the world and in many industries work with digital technologies (Westerman et al., 2014). They researched hundreds of companies, and studied how those companies approach digital innovations and the results they found because of them.

Companies that struggle with digitisation fail to develop digital capabilities to change processes and leadership capabilities to set new visions (Westerman et al., 2014). Digital capabilities can be seen as the ability to use digital technologies to improve on the overall processes within an organisation, like the customer experience or the operational processes (Westerman et al., 2014). Leadership capabilities focus on the ability to envision, drive and govern the digital transformation at hand (Westerman et al., 2014). Westerman, Bonnet and McAfee call companies that strive at both the digital capabilities and leadership capabilities: Digital masters. George Westerman, Maël Tannou, Didier Bonnet, Patrick Ferraris and Andrew McAfee created the four levels of digital mastery in 2012, which aims to provide a framework for understanding and assessing an organisation's digital capabilities and leadership (Westerman et al., 2014).

Westerman's terminology for digital mastery is highly respected and used due to the deep empirical support of the research by Westerman (Nasution et al., 2020). Digital mastery is the ability to use digital technologies to increase performance indicators within an organisation (Westerman et al., 2014). Digital mastery is paramount for any organisation, as the world is undergoing a rapid and profound transformation into a more digital focused environment

(Westerman et al., 2014). New digital solutions create other new opportunities for innovations, but also create challenges for every industry and organisation. To survive and thrive as an organisation in this new digital era, one must reinvent themselves and leverage digital technologies in their processes.

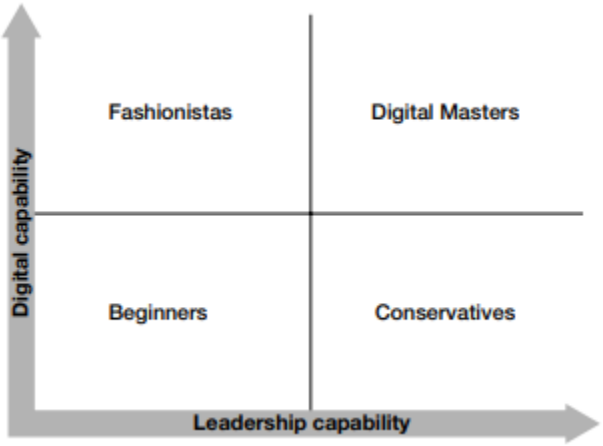

Figure 4: Four levels of digital mastery (Westerman et al., 2014, p. 15)

The four levels of digital mastery are based on a two-dimensional system, pertaining to an organisation's digital capabilities and its leadership capabilities. Organisations are scored based on these principles and are then classified into one of four levels. The first available level are the beginners, scoring low in both digital capabilities and leadership capabilities. These organisations can be unaware of digital opportunities happening right around them, or they lack the leadership capabilities to act on them (Westerman et al., 2014). They often only have basic digital capabilities and fall behind compared to the performance of competitors in their field. Fashionistas follow, being organisations that have high digital capabilities, but still lack leadership capabilities (Westerman et al., 2014). Fashionistas often invest in every new digital innovation but have little investment in a clear vision or governance of the technology at hand. Organisations that fall in this level can waste resources on separated digital innovations that are not integrated into their organisation, causing their processes to receive little to no positive effect from the innovation (Westerman et al., 2014). As their name might suggest, Fashionistas can deceive in their trendiness status, and can find it difficult to create actual lasting value from their investments into digital innovations. Organisations that have high leadership capabilities but lack in their digital capabilities are classified as Conservatives (Westerman et al., 2014).

Organisations that fall under Conservatives have a clear vision and know how to govern their process but remain too cautious in their innovation. They can also display a sort of tardiness when it comes to implementing lasting innovations (Westerman et al., 2014). Conservatives have a solid foundation, but their lack of innovating might lead to missing out on opportunity and differentiation to their competitors. Organisations that have both high digital capabilities and remain to keep high leadership capabilities are classified as Digital Masters, the sought after level for every organisation (Westerman et al., 2014). They are able to exploit digital technologies to their fullest extent, to transform their processes to a more digital age. They have a common vision within, a strong governance model and have access to a solid technology leadership. Digital Masters outperform competitors in their field (Westerman et al., 2014).

To understand an organisation's position on the four levels of digital mastery, a self-assessment can be performed to decide the placement on both dimensions. Appendix O contains the self-assessment statements surrounding the leadership capabilities of an organisation. It is meant to help an organisation understand their leadership capabilities. Every question listed should receive a score from one to seven, one being strongly disagree and seven meaning strongly agree (Westerman et al., 2014). Four means neutral. Adding these scores together will result in a score in a range from ten to seventy; the self-assessed leadership capability score (Westerman et al., 2014). A score from ten to forty-one means the organisation is plotted in the left half of the distribution. A score of forty-two to seventy is plotted in the right half (Westerman et al., 2014).

Appendix P contains the self-assessment statements surrounding the digital capabilities of an organisation. It is meant to help an organisation understand their digital capabilities. Every question listed should receive a score from one to seven, one being strongly disagree and seven meaning strongly agree (Westerman et al., 2014). Four means neutral. Adding these scores together will result in a score in a range from ten to seventy; the self-assessed digital capability score (Westerman et al., 2014). A score from ten to forty-one means the organisation is plotted in the bottom half of the distribution. A score of forty-two to seventy is plotted in the top half (Westerman et al., 2014).

3 Results: Digital transformation assessment in golf

To answer the primary research question and move towards a solution to the problem statement, the secondary research questions are explored and answered. Each secondary research question chapter explored here will contain a research summary, result summary and full research analysis. The research summary gives a brief description of the research executed to answer the secondary research question. The result summary contains a short overview of the results found. The full research analysis includes the complete research process undertaken to address the secondary research question.

3.1 First secondary research question: Digital transformation assessment

In this chapter, the results of the first secondary research question; “How is digital transformation assessed?”, will be examined. This secondary research question was conducted through a literature review to identify current models and methods. Keywords were made and searched for within applicable papers. To retrieve papers, a snowballing technique was used. The papers resulted in common themes and a literature analysis was performed.

To understand the goal of the secondary research question; “How is digital transformation assessed?”, it needs to be dissected and understood. The secondary research question aims to highlight an assessment solution solely for digital transformation, not technology transformation as a whole. The term “digital” in digital transformation in this case refers to digital technologies that can be defined as combinations of information, computing, communication and connectivity technologies (Bharadwaj et al., 2013). To define digital transformation, the unified definition of digital transformation is taken from Gong and Ribiere (2021), which states digital transformation to be “A fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders.” (p. 12). As shown in chapter 1.3.5, the result of this secondary research question is used by the fourth and sixth secondary research question.

Data sources
Google Scholar, ResearchGate, IEEE Xplore, Scopus, WorldCat

Table 2: Data sources for initial keyword searches

The data sources listed in Table 2 will be used to provide the results for the initial keyword findings explored from the understanding of the secondary research question at hand.

Keywords
Digital, Transformation, Digital + Transformation, Digital + Transformation + Model, Digital + Transformation + Assessment, Digital + Transformation + Review, Digital + Transformation + Applied

Table 3: Initial keywords first secondary research question

Using the information found in regard to the definition of the secondary research question, keywords that can be used to search for a first list of papers can be determined. These are shown in Table 3. Not every keyword should be used to search independently, as the results might not bear what is expected. That is why some are concatenated with others to remain in the right context.

Screening phase	**Inclusion criteria**
Primary screening	1. English language 2. Search keywords identified in the title or text of displayed search result 3. Not restricted to a time period 4. First 20 hits sorted by relevance 5. Scientific material 6. No duplicates
Secondary screening	1. A research article / study or a scientific publication 2. Addressing digital transformation in the context of this research
Final screening	1. Full-text article available 2. Correct licensing and open permissions

Table 4: Screening phases with inclusion criteria

The execution of the literature review will follow the search process and inclusion criteria of Teichert (2019), who performed a similar research process for performing a systematic literature

review of digital transformation maturity: A preliminary search with keywords will be executed. A primary screening will be performed, where first hits will be assessed by applying the inclusion criteria of limiting it to the first twenty results, and having the keywords be present in either the title or the abstract. A secondary screening includes comparing the abstract and text to the matter at hand. After that, the availability of the research will be checked to ensure that it is usable within this research. The difference to the screening of Teichert (2019) for this research is that the inclusion criteria are not limited to industrial company context and focus on digital transformation instead of digital transformation maturity to better fit the requirements of this research. The reference list screening phase is removed from the screening phases used by Teichert (2019), as a snowballing technique will be used and thus another method of screening is applied.

Digital	-
Transformation	-
Digital + Transformation	(Kraus et al., 2021) (Gong & Ribiere, 2021) (Verina & Titko, 2019) (Morakanyane et al., 2017) (Magesa & Jonathan, 2020)
Digital + Transformation + Model	(Bellantuono et al., 2021)
Digital + Transformation + Assessment	(Westerman et al., 2014) (Furjan et al., 2018) (Pihir et al., 2018) (Rodríguez-Abitia & Bribiesca-Correa, 2021) (Marks & Al-Ali, 2022)
Digital + Transformation + Review	(Vial, 2021) (Zaoui & Souissi, 2020)
Digital + Transformation + Applied	(Heilig et al., 2017)

Table 5: Initial keyword findings (Data sources listed in Table 2, Keywords listed in Table 3, Criteria listed in Table 4)

Using the keywords listed in Table 3 on the data sources in Table 2, in combination with the criteria listed in Table 4, results were found and displayed in Table 5. In total, fourteen sources were found that match the criteria.

The references from each source found and displayed in Table 5 were examined and compared to the aforementioned criteria in Table 4. The results of all sources found using backward snowballing are shown in Appendix I. In total, forty-seven sources were found, including the original sources listed in Table 5.

The resulting references from Appendix I were examined. Themes were extracted and presented in Appendix J.

Themes from Appendix J were congregated into characteristics of digital transformation in Appendix K. If a singular definition for a theme was found, that definition was rewritten and displayed solely. Using the characteristics and themes from Appendix K, used by ranking by frequency, a good overview of digital transformation has been made. This can be used in the following step, where an overview of models, methods or frameworks will be explored and compared to the information found in the previous steps.

The secondary research question “How is digital transformation assessed?” aims to answer the assessment of digital transformation on a more generic and global scale. Appendix K contains the characteristics of digital transformation within the scope of this research found during the research for this secondary research question. Whilst the entirety of Appendix K can be used in further research, the most important characteristics of digital transformation are extracted. A shorter conclusion will follow later in this secondary research question:

Digital transformation is characterised as a fundamental change process (Verina & Titko, 2019; Vial, 2021) associated with the application of digital technology in all aspects of human society, caused by the digital adoption of entities and strategy concerning resources and capabilities (Parviainen et al., 2022; Gong & Ribiere, 2021; Vial, 2021). The increasing digitisation of economies (Kraus et al., 2021) and digital transformation is of utmost importance as it affects every sector (Heilig et al., 2017), resulting in fundamental changes to how businesses operate and value is created (Magesa & Jonathan, 2020). Whilst digitisation and digitalisation are

essentially about technology, digital transformation is characterised as being about the customer (Verina & Titko, 2019). A participatory and human-centric approach in managing a complex I4.0 transition can be used, meaning that actors involved and affected by change must be an active part in the digital transformation (Bellantuono et al., 2021). A possible challenge for organisations is the potential use by customers (Marks & Al-Ali, 2022). The customer journey and satisfaction are crucial factors in digital maturity (Gollhardt et al., 2020). Competitors, customers, regulatory authorities and other stakeholders who implicitly influence the processes are a part of an ecosystem (Paulus-Rohmer et al., 2016). An organisation should not focus merely on its value chain, but for the entire ecosystem and in which position the organisation wants to occupy that ecosystem (Paulus-Rohmer et al., 2016). Digital technologies have been widely integrated in different sectors and within every dimension of human life (Magesa & Jonathan, 2020). Digitisation is the process of digitising something, which in turn means the conversion of analogue to a digital form (Parviainen et al., 2022).

Maturity models aim to assess a company‘s positioning and as-is situation, define and systematise improvement initiatives and navigate through the evolutionary process (Gollhardt et al., 2020). A model is an abstract copy of reality (Gollhardt et al., 2020). An organisation's current status and position can be assessed using a variety of methods, models and frameworks designed to gauge digital maturity (Pihir et al., 2018). A digital assessment can be done through a series of questions concerning an organisation and its strategy and current state (Marks & Al-Ali, 2022).

The research conducted concluded the following answer to the secondary research question: “How is digital transformation assessed?”:

- Digital transformation is a fundamental change process associated with the application of digital technology.
- The increasing digital transformation is of utmost importance as it affects every sector, resulting in fundamental changes to how businesses operate, and value is created.
- Whilst digitisation and digitalisation are essentially about technology, digital transformation is characterised as being about the customer.
- A possible challenge for organisations is the potential use by customers.
- The customer journey and satisfaction are crucial factors in digital maturity.

- An organisation should not focus merely on its value chain, but for the entire ecosystem and in which position the organisation wants to occupy that ecosystem.
- Digitisation is the process of digitising something, which in turn means the conversion of analogue to a digital form.
- Maturity models aim to assess a company‘s positioning and as-is situation, define and systematise improvement initiatives and navigate through the evolutionary process.
- An organisation's current status and position can be assessed using a variety of methods, models and frameworks designed to gauge digital maturity.
- A digital assessment can be done through a series of questions concerning an organisation and its strategy and current state.

These findings and subsequent characteristics of digital transformation will be used in the following secondary research questions to understand the circumstances surrounding the scope of the research, and to be able to find relevant results and solutions that fit the findings of this secondary research question. Important takeaways include the effect digital transformation has on all sectors and value creation of businesses, and the inclusion of customer satisfaction to determine digital maturity as an as-is situation, as it plays on the role and scope of this research that aims to determine the digital transformation of the Dutch golf ecosystem.

3.2 Second secondary research question: Ecosystems, entities and centralisation

In the scope of this research, the aim is to assess digital transformation within an ecosystem of entities, which have been explored in chapter 1.1.2. As mentioned in chapter 1.1.4, a centralised organisation is better in times where an organisation needs to adapt to change (Alonso et al., 2012). Clear and concise definitions of an ecosystem, entities and centralisation need to be explored. In this chapter, the results of the second secondary research question; "What are ecosystems, entities and centralisation?", will be examined. This secondary research question was conducted through a literature review to identify the definitions in the context of this research. Keywords were made and searched for within applicable papers. To retrieve papers, a snowballing technique was used. The papers resulted in common themes and a literature analysis was performed.

The scope of this thesis pertains to digital transformation, as elaborated upon in section 3.1, in the context of a business or other organisational venture. The secondary research question, "What are ecosystems, entities and centralisation?" aims to define these terms within this same context. As shown in chapter 1.3.5, the result of this secondary research question is used by the third and fifth secondary research question.

The data sources listed in Table 2 in section 3.1 will be used to provide the results for the initial keyword findings explored from the understanding of the secondary research question at hand.

Keywords
Ecosystem + Definition, Entity + Definition, Centralisation + Definition, Ecosystem + Organisation, Entity + Organisation, Centralisation + Organisation

Table 6: Initial keywords first secondary research question

Using the information found in regard to the definition of the secondary research question, keywords that can be used to search for a first list of papers can be determined. These are shown in Table 6. Not every keyword should be used to search independently, as the results might not bear what is expected. That is why some are concatenated with others to remain in the right context. The definitions of the terms will be searched for, after which the terms will be entered with the organisation keyword, to align with the context of a business or other organisational venture as previously stated.

The same execution and screening method will be used to answer this secondary research question as the first secondary research question in section 3.1, with an exception to the second step in the secondary screening where this method will address the definitions of the terms in the context of this research.

Ecosystem + **Definition**	(Tsujimoto et al., 2018) (Bogers et al., 2019) (Granstrand & Holgersson, 2020)
Entity + **Definition**	(Malik et al., 2011)
Centralisation + **Definition**	-
Ecosystem + **Organisation**	(Adner, 2017) (den Hartigh & Asseldonk, 2004) (Lu et al., 2014) (Fu et al., 2024) (Paulus-Rohmer et al., 2016)
Entity + **Organisation**	(Biondi, 2005)
Centralisation + **Organisation**	(Andrews et al., 2009) (Arnold, 1999) (Chang & Harrington, 2000)

Table 7: Initial keyword findings (Data sources listed in Table 2 of section 3.1, Keywords listed in Table 6, Criteria listed in Table 4 of section 3.1 with changes listed in this section)

Using the keywords listed in Table 6 on the data sources in Table 2 of section 3.1, in combination with the criteria listed in Table 4 of section 3.1 with changes listed in this section, results were found and displayed in Table 7. In total, thirteen sources were found that match the criteria.

The references from each source found and displayed in Table 7 were examined and compared to the aforementioned criteria in Table 4 of section 3.1 with changes listed in this section. The results of all sources found using backward snowballing are shown in Appendix L. In total, twenty-seven sources were found, including the original sources listed in Table 7.

The resulting references from Appendix L were examined. Themes were extracted and presented in Appendix M. It is remarkable that, despite the listed snowballing efforts to find a definition for an entity through accumulated sources, no meaningful definition or theme emerged.

Themes from Appendix M were congregated into characteristics of ecosystems, entities and centralisation in Appendix N. If a singular definition for a theme was found, that definition was rewritten and displayed solely. Using the characteristics and themes from Appendix N, used by ranking by frequency, the answer to this secondary research question was found and formulated. Only the definition of an entity was not established through this research method. The answer to that part of the secondary research question can be formulated however, seeing how mentions of an entity, or actor for that matter, have been made in other pieces of literature explored for other definitions in this secondary research question.

The secondary research question, "What are ecosystems, entities and centralisation?", is in itself a three-part question. Breaking down the request for three definitions, starting with an ecosystem: An ecosystem, in the scope of this research, is a collection of loosely connected networks of entities (Battistella et al., 2012; Borgh et al., 2012) jointly creating value that no single actor would be able to do (Bogers et al., 2019). It is both a complex living entity (Tsujimoto et al., 2018), and an interdependent set of actors with varying degrees of multilateral, non-generic complementarities that are not fully hierarchically controlled (Jacobides et al., 2018). Ecosystems can overlap and can consist of multiple types of entities, like competitors, customers, regulatory authorities and other stakeholders (Paulus-Rohmer et al., 2016). Ecosystems are valuable, as the success of individual innovation is often dependent on the success of other innovations in an entity's external environment (Adner & Kapoor, 2010). Each entity in the ecosystem has different attributes, decision-making principles, and purposes (Tsujimoto et al., 2018), whose business decisions or actions impact all of the interrelated entities (Battistella et al., 2012). Organisations are embedded within their environments and their conditions (Richardson et al., 2002; Kapoor & Lee, 2010), where ecosystems provide structure where complementaries can be contained and coordinated whilst allowing for a complex interdependent product or service to be produced (Jacobides et al., 2018).

Kapoor and Lee (2010) make mention of interdependent activities, performed by customers, complementors and suppliers. This is precisely the definition that can be formed for an entity in the scope of this research. Battistella et al. (2012) also make mention of entities, stating that

business ecosystems are formed by them. Granstrand and Holgersson (2020) state the performance of actors or a population of actors. Adner (2017) uses the definition partners, to further underline the inter dependability. An entity, in the scope of this research, is understood as any body that actively participates in the ecosystem by bringing value to the ecosystem. Because of the notion that an ecosystem consists of customers, complementors and suppliers made by Kapoor and Lee (2010), it is concluded that customers within an ecosystem are also members of said ecosystem, instead of outside actors requesting value from that ecosystem.

Type	**Definition**
Shaper (den Hartigh & Asseldonk, 2004)	Sponsoring their own proprietary technology (den Hartigh & Asseldonk, 2004)
Adapter (den Hartigh & Asseldonk, 2004)	Developing their own product or service based on a shaper's technology (den Hartigh & Asseldonk, 2004)
Opportunist (den Hartigh & Asseldonk, 2004; Lu et al., 2014)	Waiting for new opportunities (den Hartigh & Asseldonk, 2004; Lu et al., 2014)
Facilitator (Fu et al., 2024)	Linking actors in the ecosystem, orchestrate resources across people, goods, and scene (Fu et al., 2024)

Table 8: Ecosystem innovator types

Table 8 explores the definitions of ecosystem innovator types.

Centralisation is the act of providing a centre with little general autonomy in terms of making decisions about how it is run (Richardson et al., 2002). The degree of centralisation is displayed through the amount of power distribution that is displayed among social positions (Hage & Aiken, 1967). A centralised organisation will have a high degree of hierarchical authority and low levels of participation in decisions about policies and resources (Andrews et al., 2009). Hierarchy of authority speaks to the extent to which decision making power is formed at the upper levels of organisational hierarchy, whereas participation of decision-making speaks to the extent to which other levels are involved in determining policies (Andrews et al., 2009). A decentralised organisation will typically be characterised by low hierarchical authority and highly participative decision making (Andrews et al., 2009).

The research conducted concluded the following answer to the secondary research question: “What are ecosystems, entities and centralisation?”:

- An ecosystem is a collection of loosely connected networks of entities, jointly creating value through interdependent interactions.
- An entity is any active value-bringing participant in an ecosystem.
- Centralisation means the concentration of decision-making power and authority at a central point within an organisation or system.

These definitions and subsequent characteristics of the definitions will be used in the following secondary research questions to understand the circumstances surrounding the scope of the research, and to be able to find relevant results and solutions that fit the findings of this secondary research question. Key takeaways include the broad scope of ecosystems, where the reach can be undetermined, entities being any active value-bringing participant and centralisation specifying the concentration of decision-making power within an ecosystem, as it tells more about the operation and scope of ecosystems and what the centralising efforts of the NGF might entail.

3.3 Third secondary research question: Dutch golf ecosystem

In this chapter, the results of the third secondary research question; “What are the characteristics of the golf ecosystem?”, will be examined. This secondary research question was conducted through a series of interviews to identify the characteristics of the golf ecosystem in the Netherlands. These interviews were conducted based on information retrieved in communication with the NGF. Semi structured interviews with various stakeholders and entities within the golf ecosystem were conducted.

As Kapoor and Lee (2010) were found to mention in chapter 3.2, an ecosystem is a bundle of interdependent activities, performed by customers, complementors and suppliers. In chapter 3.2, the conclusion was made that customers are also a part of an ecosystem. It was also concluded in chapter 3.2, that each entity in the ecosystem has different attributes, decision-making principles, and purposes (Tsujimoto et al., 2018), whose business decisions or actions impact all of the interrelated entities (Battistella et al., 2012).

As a proposition to the research goal, the NGF is viewed as the centralised association within the Dutch golf ecosystem. Because of the NGF’s understanding of the trends in digital innovation within the ecosystem, as explored in chapter 2.2 mentioning their 2023 digital innovations for golf report, this research will view their perception of ecosystemic digital technology innovation leaders as truth. In cooperation with the NGF, a list of ecosystemic digital technology innovation leaders is made.

Ecosystems comprise of customers and value-bringing suppliers and complementors, as explored in chapter 3.1. This is why it is crucial to explore both the digital innovation within the customer’s front as the digital innovation for the suppliers and complementors. Looking at chapter 2.1 and the overall understanding of the sport of golf, the golf clubs are value bringing in that they facilitate a golfer’s need for a location to undertake the sport of golf. Since the scope of this research pertains to the digital transformation within the golf ecosystem, and specifically aiming to validate the transformation surrounding golf courses in the Netherlands, it is decided that the golf courses and golfers are the two main value bringing entities within the Dutch ecosystem to be researched in this secondary research question. The golfer is central to the sport, as they are the ones to undertake the sport as explored in chapter 2.1. This conclusion of the two types of entities within the ecosystem to be researched does not mean that they are the sole value bringing entities.

Stakeholder	Type (From Table 8 in chapter 3.2)
E-Golf4U	Shaper
NGA	Opportunist
Duchell	Facilitator
PGA	Opportunist

Table 9: Stakeholders within the Dutch golf ecosystem that were interviewed

As mentioned in chapter 1.3.3, the NGF was contacted in order to find the most important stakeholders that were asked to participate in the research. Sixteen stakeholders under the notion of being ecosystemic digital technology innovation leadership for the Dutch golf ecosystem were contacted about participating in an interview. With the help of the NGF, the stakeholders they provided were linked to types within the ecosystem that were found and explored in chapter 3.2. The most prominent types within the ecosystem will most likely be facilitators. Because they serve as gateways for information and products, they could be the most likely entities to observe new innovations as buying behaviour within the ecosystem. Opportunists are more likely to wait for new innovations and may use them before innovating their own processes. Adapters are already developing their processes and products to align with innovations. Shapers could also serve as a good indicator for new innovations within the ecosystem but lack the behaviour of value using entities within the ecosystem. Aligning the types of the stakeholders will allow for a good selection to be made, restraining the possibility that not every identified type was interviewed.

Interviews were held with four stakeholders that responded to the inquiry of participating in the research. These stakeholders are listed in Table 9, along with their given type within the ecosystem. Interviews with representatives of the PGA Holland, NGA, Duchell and E-Golf4U were held. An interview with representatives of the NGF was also held. The automatic transcripts of these interviews are available in an out-of-document appendix, also with the corresponding audio files.

The most notable quotes from the interviews are listed provided in the appendix of this research. These quotes were extracted, translated to English, paraphrased to allow conclusions to be drawn and provided here for this secondary research question. These are the most important findings:

The NGF started to think about digital solutions years after other sports had accepted them (Appendix D, 01:01. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). The conversion to acceptance of a digital solution spanned at the very least 6 years (Appendix D, 06:05. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). Older golfers are more hesitant in accepting new digital solutions compared to their younger peers (Appendix D, 06:05. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). The current target audience for golf consists of white men between the ages of 30 to 70 years old (Appendix D, 10:51. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). The sought after target audience by the NGF are men and women between the ages of 20 to 50 years old, with a slight emphasis on women (Appendix D, 10:51. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). Golf clubs need to accept digital technology in order to remain a member of the NGF (Appendix D, 13:18. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). Just like a golfer is a member of a golf club, golf clubs are a member of the NGF (Appendix D, 13:18. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). The ongoing debate and conservative leanings regarding the suggested golf ball rollback rules reflect golf's inherent resistance to change (Appendix D, 34:49. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). The NGF had their digital solutions for member registration ready in half a year, but it took 3 years of politics to convince golf clubs to switch to the new digital solution (Appendix D, 41:46. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). If golf clubs are not willing to switch to the new digital solutions, they are no longer eligible for an NGF membership (Appendix D, 41:46. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)).

Some golf clubs are currently converting their original driving ranges from the 80’s to digital driving ranges (Appendix G, 38:13. Full transcript of the interview is available in out-of-document Appendix PGA Holland (Voice 008)). Eventually, all golf clubs are turning

their driving ranges digital (Appendix G, 38:13. Full transcript of the interview is available in out-of-document Appendix PGA Holland (Voice 008)).

The cooperation between the NGA and the NGF is good. There is a triangle-shaped golf alliance between the NGA, NGA and NVG. (Appendix H, 13:01. Full transcript of the interview is available in out-of-document Appendix NGA (Voice 011)).

Gamification is increasing in importance and broadens the target audience (Appendix E, 03:08. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). When you want to get more youth, and more people, into the game of golf on a low threshold level, digitalisation is the most important starting point (Appendix E, 03:08. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). Within the scope of gamification equipment, Duchell is seen by the market as having an authority role (Appendix E, 06:59. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). There is rarely communication between Duchell and the NGF (Appendix E, 09:26. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). The Netherlands is ahead of digitalisation compared to Belgium, France and Germany. Something that is accepted here is accepted only 2 to 4 years later in other European countries. The adoption of digitalisation in the Netherlands is good (Appendix E, 10:24. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). The NGF has, within the last few years, shifted from being an internally focused organisation to an organisation that is focussed outwards (Appendix E, 11:22. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). Golfers who play on courses that have little to no digital technologies are more often than not elderly golfers (Appendix E, 14:11. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). The golf market is still very biassed and traditional (Appendix E, 35:54. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). Golf club boards that are reluctant to adopt a digital strategy are conservative and are often not open to new target audiences (Appendix E, 35:53. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). Golf clubs can have a hint of arrogance due to the recent success of golf during COVID (Appendix E, 35:53. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). The golf market has been very traditional, hesitant and arrogant. In the past 2 to 4 years, a shift is happening that is making golf more fun, easier to access. The NGF is

partly to thank (Appendix E, 37:28. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)).
The NGF manages the entire handicap system. This used to be the responsibility of the software vendors, but nowadays is at the NGF (Appendix F, 02:33. Full transcript of the interview is available in out-of-document Appendix E-Golf4U (Voice 006)). The tee time reservation system has seen an explosive boom since COVID, but CRM products for golf courses were already present in the 2000's (Appendix F, 06:04. Full transcript of the interview is available in out-of-document Appendix E-Golf4U (Voice 006)). The Netherlands is progressive in digital technologies, whereas Austria is lacking behind (Appendix F, 11:40. Full transcript of the interview is available in out-of-document Appendix E-Golf4U (Voice 006)). The Netherlands is behind the USA on digital technologies (Appendix F, 11:40. Full transcript of the interview is available in out-of-document Appendix E-Golf4U (Voice 006)).

After the interviews, the following important conclusions can be drawn:

- Golf has been slower to embrace digital solutions compared to other sports.
- For golf courses to remain members of the NGF they must adopt digital technologies.
- The ongoing debate and conservative attitudes regarding the proposed rollback of golf ball rules highlight the sport's inherent resistance to change. This is also shown in the time it took to convince golf courses to switch to a new digital solution.
- In terms of digitalisation, golf in the Netherlands is more advanced than in Belgium, France, Austria, and Germany, but it is behind the USA.
- Some golf courses are transforming their driving ranges into digital ones, and it is expected that all courses will eventually do the same.
- Golf courses that resist adopting a digital strategy are typically conservative and not open to attracting new audiences.
- Historically, the golf market has been very traditional, hesitant and somewhat arrogant. However, over the past two to four years, there has been a shift making golf more enjoyable and accessible. In recent years, the NGF has evolved from an internally focused organisation to one with an outward focus.
- Currently, the target audience for golf in the Netherlands comprises white men aged 30 to 70 years old. Elderly golfers predominantly play on courses with minimal digital

technology. The goal by the NGF is to attract a younger demographic, including both men and women.

- Increasing gamification within the golf ecosystem is expanding the target audience and overall digitisation will lower barriers, encouraging more young people to take up the game.

The conservative nature of golf highlighted by the stance surrounding rule changes and the stubbornness towards digital technologies could be linked to its slow adoption of digital innovations. The requirement by the NGF for courses to adopt digital technologies to maintain their membership with them suggests a direct causality between the NGF's policies and the push towards modernisation. The conservative nature of golf courses that resist digital strategies directly impacts their ability to attract new audiences from a younger audience, precisely the audience the NGF is trying to reach. There is a causative relationship between the lack of digital adoption and the failure to draw in a younger, more diverse demographic. The shift in the golf market over the past two to four years towards a more accessible and enjoyable experience has caused the NGF to evolve and focus on external engagement. The preference of elderly golfers for minimally digital courses could show a generational divide between them and the younger, more diverse audience that the NGF want to reach. This preference could be a case for a slower rate of digital adoption, as courses cater to their existing older golfing members rather than risking alienating them. Increasing gamification and overall digitisation could be causally linked to lowering barriers for young people to take up golf. These innovations make the sport more appealing and accessible, therefore expanding the target audience to a more fitting target demographic as sought after by the NGF.

As these findings show, the Dutch golf ecosystem may provide a good case study to test a possible model, as seen by statements like having a different possible target audience compared to the current target audience of golf. A switch in target groups might need a good understanding of current situations. Digital transformation and the positioning in regard to digitisation are among those situations. The statement that elderly golfers, the target group that the NGF wants to move away from, tend to play more golf on more digital minimalistic golf courses, might show a hypothesis that courses with a low emphasis on a digital strategy could also see a digital lacking audience, which in turn might lead to an older audience. To prove this, one would need

to find a model to use, which is precisely what this research aims to discover. The increase of gamification, a part of digitisation efforts, was also found to increase the younger audience.

3.4 Fourth secondary research question: Golf ecosystem digital transformation assessment

In this chapter, the results of the fourth secondary research question; "How is digital transformation in the golf ecosystem assessed?", will be examined. This secondary research question was conducted through a secondary analysis of results explored by secondary research questions prior to this secondary research question. Definitive statements, findings, data and sources uncovered in previous secondary research questions were used to determine a model suitable for the necessary change to better align with the specific requirements of assessing digital transformation within ecosystems.

3.4.1 Customer inclusion

As explored in chapter 3.1, customer inclusion in digital transformation is essential in a correct transition and transformation. It is imperative that organisations not only focus on their own value creation but also their customer and customer segments. As expounded in chapter 3.2, an organisation can also be an ecosystem and vice versa. Using this information, it can be determined that ecosystems too should progress on two dimensions to be digital masters: Digital capabilities and leadership capabilities (Capgemini, n.d.). Research on how to assess these two dimensions has been explored previously in chapter 2.3; Four levels of digital mastery by Westerman et al. (2014). This model is used, partly because of its simplicity (McKeown, 2020) and its deep empirical support (Nasution et al., 2020), by organisations to assess their own digital mastery (McKeown, 2020). The aim and scope of this research is to provide such an opportunity too, as mentioned in chapters 1.2 and chapter 1.4, but for an entire ecosystem by a central organisation. A change in the model by Westerman et al. (2014) is therefore explored.

As Kapoor and Lee (2010) were found to mention in chapter 3.2, an ecosystem is a bundle of interdependent activities, performed by customers, complementors and suppliers. In chapter 3.2, the conclusion was made that customers are also a part of an ecosystem. As expounded in chapter 3.1, customer inclusion is an important part in the digital transformation journey, as it impacts not only organisations but also customers. Emphasising their inclusion is the analysis in chapter 3.2, mentioning entities within an ecosystem also including the customer. Also exploring the customer inclusion and value bringing components in the form of golfers and golf clubs is chapter 3.3. Integrating this highlighted importance in a model is a necessity after these findings

surfaced. The first proposed change to the model by Westerman et al. (2014) is therefore to include a customer focused aspect.

In the scope of this research, a comparison between the customer, as explored in chapter 2.1 to be the golfer, and the course should be possible. With customers, the most prominent value-takers are meant. The two dimensions of the model by Westerman are "digital capabilities", as explored in chapter 2.3 pertaining to the digital technology usage by an organisation, and "leadership capabilities", as explored in chapter 2.3 pertaining to the way an organisation has its leadership and leadership capabilities setup. The most fitting way to include a customer focused aspect in the model is to specify the "digital capabilities" as the digital capability by a customer, in this case the golfer, since the comparison best fitting the scope of this research can only be made by comparing a golfer's digital use with the course's leadership instead of the other way around.

Removing the golfer specific elements, there is a model left that could be used for generic use of assessing digital transformation in ecosystems.

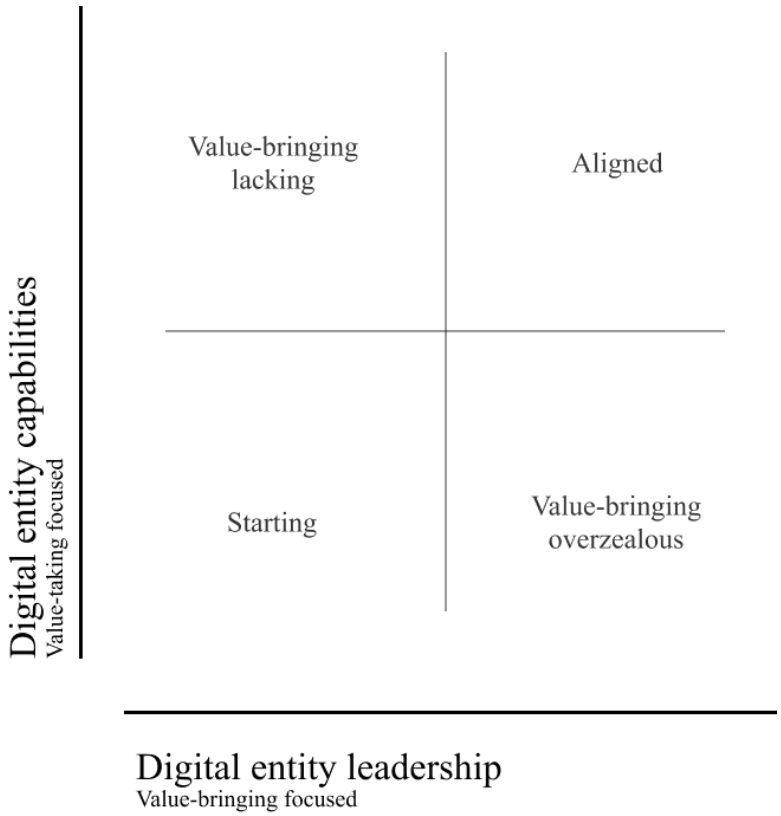

Figure 5: Ecosystemic Digital Technology Transformation Model

Figure 5 shows the *Ecosystemic Digital Technology Transformation Model* as influenced by Westerman et al. (2014), with the addition of a customer focused component. The X-axis is changed to pertain to the customer's digital capabilities, which will be explored in a specified golfer focused use case in the following subsections. The Y-axis pertains to the digital leadership of the value-bringing entity, which will be explored further in following subsections, in terms of the Dutch golf ecosystem. The quadrants in the model mean the same as in research by Westerman et al. (2014), except that the quadrant on the bottom right and the quadrant on the top left are flipped for the customer. Starting still means that both entity groups, value-bringing and value-taking, are at the forefront of digital mastery. Value-bringing overzealous relates to the idea that the value-bringing entity is too far ahead of the ideas and expectations of the value-taking entities. Value-bringing lacking means the exact opposite: the value-bringing entity is behind the value-taking entities. Aligned means that both groups are aligned to the expectation and reality of each other. These labels are merely meant as cosmetics with room for creativity. Specifying the cosmetic labels to an ecosystem is done in subsequent subchapters, in this case for the Dutch golf ecosystem.

3.4.2 Course leadership

The scope of this research has no need for the inclusion of separate insights on the leadership of an organisation other than those focused on the digital aspect. This digital aspect combined with the inclusion of a golfer focused dimension and the scope of this research necessitating a comparison means the "leadership capabilities" are further specified to be the "Digital course leadership".

A sense of how to measure the leadership capabilities of an organisation can be derived when looking at Westerman et al. (2014). They construct methods to extract knowledge about the extent at which an organisation is able to craft digital visions, engage the organisation, govern the transformation and build the technology leadership capabilities. Westerman et al. (2014) also include a Digital Mastery Self-Assessment, as explored in chapter 2.3. Looking at Table A.2 from Westerman et al. (2014), also explored in chapter 2.3, the statements are explored. The statements from the Self-Assessment by Westerman et al. (2014) expect a self-scoring using a scale of one to seven, where one means one strongly disagrees and seven means one strongly

agrees. The sum of the scores for each statement totals to the leadership capability score. Both the reliability and the validity of the results by a questionnaire using a Likert-type scale are independent of the number of scale points (Jacoby & Matell, 1971). Taherdoost (2019) advises using a seven-point scale when there is no need to have a respondent be directed to one side. Lehmann and Hulbert (1972) suggest that, when the focus is on individual behaviour, a five- to seven-point scale should be used. Seeing this information, it is decided to hold true to the original scale that Westerman et al. (2014) used in the Self-Assessment of exploring an organisation's ability to build leadership capabilities.

To allow a good understanding by the participants, some alterations to the original statements by Westerman et al. (2014) will be made. Mentions of executives will be changed to specify the golf course itself, allowing for differently structured golf organisations to participate. The same goes for mentions of a company, which will be changed to specify the golf course. The mention of silos will be altered to specify committees. The last two statements, "IT and business leaders work together as partners" and "The IT unit's performance meets the needs of the company" will be removed, as it is not expected of a golf course to have a dedicated IT department or unit.

3.4.3 Placement on model and understanding of results for courses

After both the course and the players have finalised filling in the questionnaire, a method is devised with which the two results can be added together. A question will be added at the beginning asking the participant what course they are representing. The result is used to later couple that result to the golfer aggregate.

Using all of this information, the plotting questions can be created (Appendix C, questions with Plotting label).

To further understand the placement of a course on the model, some insight questions can be created. As previously found in chapter 3.3, golfers tend to be conservative in their decision-making, and might be inherently reluctant to use digital technologies (Appendix E, 35:54. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010), Appendix D, 41:46. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). If a course is plotted tremendously low, the model might not be at fault but rather the course might be typically reluctant to use digital technologies. Using all of this information, and the cooperation (NGF, email, May 27, 2024), the insight questions can be

created (Appendix C, questions with Insights label). These insight questions are not in scope of this research however, and merely exist to possibly explain causes to remarkable results of an individual.

3.4.5 Course questionnaire validation

To validate the questionnaire, a question relating to the understandability and answerability should be added. If the participant had no difficulty understanding and answering the questions, the questionnaire, it can be safely assumed that the questionnaire is valid. Using all of this information, the validation question can be created (Appendix C, question with Validation label). The golf course questions were first sent to the NGF for validation (NGF, email, May 27, 2024). After the NGF suggested some changes, which were implemented, an external source that specialises in communication was contacted (Alex Inc. email, May 29, 2024) who also gave valuable suggestions, which in turn were also implemented. A last round of communication feedback was provided by a business development & communication expert, who has a primary role in market and client research (Business development & communication expert in the legal industry. email, May 29, 2024).

3.4.6 Golfer journey

The NGF mentions Player1st to be a tool through which golf clubs and golf courses can measure how golfers feel about their product (NGF, 2017). Looking at Player 1st (2019), a player journey is extracted where a player's experiences are displayed with touchpoints during a visit to a club. These are divisible in five parts; Before Arrival, At Arrival, Playing, After Playing and Follow Up (Player 1st, 2019). Because this research is looking at golf related touchpoints, and touchpoints where the golfer and course are in direct contact, a selection can be made within Before Arrival, At Arrival, Playing and After Playing. In these selections from the player journey, a few touch points can be extracted: Before Arrival (Booking), At Arrival (Office, Driving Range), Playing (The Course, Course Facilities) and After Playing. To add to the aggregate, example components from a SWOT analysis are taken from Cybergolf (n.d.); Tee-time reservation process, Expected course conditions, Directions, Signage, Practice Facilities, On-Course Signage and Coordinators. Using Player 1st (2019) and Cybergolf (n.d.), five phases can be derived: Finding and selecting a course, Arriving at the course, Practising at

the course, Playing the course and Finalising the visit. These phases can be used to create questions for the golfer questionnaire. If the golfer is not in agreement with the number of phases, they should be able to add more. Using this method, the need for a definitive and certain number of phases is eliminated. The aim is to get a grasp of how digital the golfer is, by looking into what steps are supported by digital technology. By asking what steps the golfer undertakes per phase, a definitive number of total steps can be created per golfer. By having the golfer themself add the different possible steps, there is no need to know beforehand every single step a golfer might take. Having some examples, however, might improve the understanding of the golfer in what the question aims to achieve. Looking at chapter 2.1, information can be gathered surrounding the game of golf and the different steps one might take. These can be added as examples, but a golfer can deselect them if they think it is not applicable. The ratio between the number of steps a golfer gives and how many of those are supported by digital technology, will be referred to as the step ratio of the golfer.

When using a different ecosystem, or generalising the model for generic use, the journey of the most prominent value-taking customer can still be researched. The same general steps can be taken, ranging from finding the customer's journey in relation to the most prominent value-bringing entity, to extracting examples. Because these will act as examples, they do not have to actually be included for the model to work. One could also make the decision to ask the participant about the number of steps and how many of those are done with digital technologies. Or they could decide to interview participants and extract the step ratio themselves. For this research, it was decided to include researched steps so that golfers got a sense of what steps the questionnaire was asking about.

3.4.7 Placement on model and understanding of results for golfers

After both the course and the players have finalised filling in the questionnaire, a method is devised with which the two results can be added together. A question will be added at the beginning asking the golfer what course they are a member of. The result is used to later couple that results to the course.

Using all of this information, the plotting questions can be created (Appendix B, questions with Plotting label).

To further understand the placement of a golfer on the model, some insight questions can be created. As previously found in chapter 3.3, golfers tend to be conservative in their decision-making, and might be inherently reluctant to use digital technologies (Appendix E, 35:54. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010), Appendix D, 41:46. Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)). If a golfer is plotted tremendously low, the model might not be at fault but rather the golfer might be typically reluctant to use digital technologies. Using all of this information, and the cooperation (NGF, email, May 27, 2024), the insight questions can be created (Appendix B, questions with Insights label). These insight questions are not in scope of this research however, and merely exist to possibly explain causes to remarkable results of an individual.

3.4.8 Golfer questionnaire validation

To validate the questionnaire, a question relating to the understandability and answerability should be added. If the participant had no difficulty understanding and answering the questions, the questionnaire, it can be safely assumed that the questionnaire is valid. Using all of this information, the validation question can be created (Appendix B, question with Validation label).
The golfer questions were first sent to the NGF for validation (NGF, email, May 27, 2024). After the NGF suggested some changes, which were implemented, an external source that specialises in communication was contacted (Alex Inc. email, May 29, 2024) who also gave valuable suggestions, which in turn were also implemented.

3.4.9 Cosmetic label changes

In chapter 2.3, the labels of Four levels of digital mastery by Westerman et al. (2014) are explored. These are slightly changed, to fit the theme and scope of the model. Because digital capabilities pertain only to the golfer, this is changed to “Digital golfer capabilities”. Leadership capabilities also only speak to the digital leadership shown by the golf course and are consequently referred to as “Digital golf leadership”.
Using the self-assessment score and the average ratio of golfers for a specific golf course, the golf course can be plotted on the model. This will be on an X-axis, ranging from 7 to 56, and a Y-axis ranging from 0 to 100. Looking at Figure 4 and the explanation of digital levels in chapter

2.3, there are levels to classify a respondent in. These levels are used to categorise organisations (Westerman et al., 2014). In this research, considering the scope, they are not a leading categorisation but meant as a cosmetic label addition to add some kind of classification to golf courses. This means that golf courses will not receive their classification alone but are met with their actual position and their position in relation to other golf courses.

In chapter 2.3, the different levels are explored. These levels can be used here to create the categorisations of golf courses. First, the names are changed to fit the golf theme. As mentioned in chapter 2.1, the names of birds correspond to a good score. This is why the names of the levels are changed to work with the names of birds. “Beginners” is changed to “Digital Fledglings”, underlining the start and inexperience within the digital realm. “Fashionistas” is changed to “Leading Owls”, where leading refers to a golfer’s enhanced digital use and owl means the hierarchical, sometimes mysterious, structured golf course corresponding to the golfer which is based on the pop culture use of owls (Atwood, 2024). “Conservatives” is changed to “Decisive Hawks”, signifying the incredible eye for digital innovations by the golf course and a well decisive manner of the golfer. The “Digital Master” is changed to “Digital Condors”, corresponding to the best score a golfer can hit on a hole.

As explored in chapter 2.3, Westerman et al. (2014) mention four levels of digital mastery. These levels have characteristics which are explored in chapter 2.3. Considering the inclusion of a customer focused aspect, and therefore a model that records two entities instead of one, these labels do not fit the situation anymore. The characteristics for “Beginners” and “Digital Masters”, in the new model mentioned as “Digital Fledglings” and “Digital Condors” respectively, can remain the same. “Digital Condors” excel both in the golfer focused digital golfer capabilities as the course focused digital course leadership (Westerman et al., 2014). “Digital Fledglings” are just at the start of their digital journey. As Westerman et al. (2014) mention “Beginners” to “*believe the digital opportunity is right for other industries, but not for theirs. Others lack the leadership to make something happen. As a result, Beginners have only basic digital capabilities.*” (Westerman et al., 2014, p15). The main difference between Westerman’s model and the new proposed model, is the split and inversion of the levels of “Fashionistas” and “Conservatives”, in the new model named “Leading Owls” and “Decisive Hawks” respectively, between the golfer and the course. A classification of a “Leading Owl” will mean that the golfer will have the characteristics of a “Fashionista” by Westerman et al. (2014),

and the course will have the characteristics of a “Conservatives”. This is reversed when the classification of a “Decisive Hawk” is made.

3.4.10 Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

The research proposed an adapted model to the secondary research question "How is digital transformation in the golf ecosystem assessed?", which can be used to assess the current state of digital transformation in the golf ecosystem.

The four levels of Digital Mastery model by Westerman et al. (2014) was used as a base for a model adapted to the previous findings of this research. A golf course will fill out a questionnaire adapted from Westerman et al. (2014) to get a score of their digital course leadership. Members of that golf course will fill out another questionnaire resulting in the average digital golfer capabilities of the members of that golf course. These numbers will determine the position of the course on the adapted *Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem*.

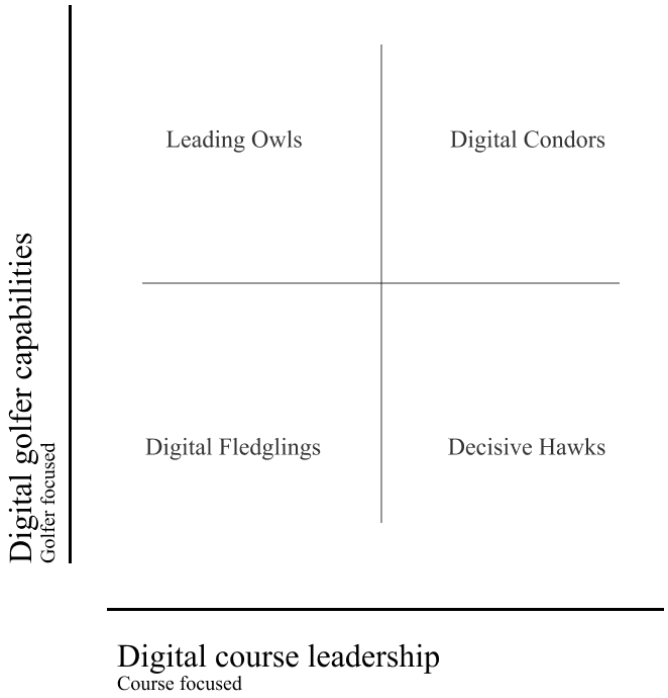

Figure 1: Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

Figure 1 shows the *Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem*, as proposed by this research.

The two axes were created based on the findings from chapter 3.1 in conjunction with the explanation of golf in chapter 2.1 and the scope of this research as defined in chapters 1.2 and 1.4: The golfer is the customer within the golf ecosystem, the golf course is the direct and most prominent value creator within the golf ecosystem. The course digital leadership placement was created using an altered version of the leadership self-assessment by Westerman et al. (2014) to fit the golf ecosystem. Mentions of companies are replaced with golf courses and the two statements regarding the IT department of a golf course are removed, because it is not expected from a golf course to have an IT department. The rest of each statement remains the same as the original statements. The golfer's digital capabilities placement was created in a new scale, using research mentioned by the NGF about the golfer's journey and a SWOT analysis about golf. The labels are changed from Westerman et al. (2014) to fit the golf theme and the new axis; Golfer and course were specified, as was the extra mention of it being digital specific. These are merely cosmetic and only serve to inform the reader. As are the new labels for the four quadrants, where they are renamed to fit the bird theme within golf previously explored in chapter 2.1 and research on the pop culture impressions of owls. The quadrant characteristics are kept the same but are reversed for the outer two when looking at the golfer.

The model, as shown in Figure 1, can be used to plot golf courses on. A golf course should fill out a questionnaire provided in Appendix C. Every plotting question of this questionnaire, identifiable by the Plotting label, results in a score ranging from one (Strongly Disagree) to seven (Strongly Agree). Adding the scores of these seven plotting questions together will result in the digital course leadership score for this particular score. This is also the placement of the course on the X-axis of the model, which ranges from seven to fifty-six. Parallel to this questionnaire, the members of the golf course should fill out the questionnaire provided in Appendix B. There are ten total plotting questions for the golfer to fill out. First, a question about what steps they encounter during a phase in their golf journey is asked. The golfer can provide the steps they encounter. That question is followed by a question on how many of those steps are supported by digital technologies. This is done five times in total. The ratio percentage between the number of steps and the amount of those steps supported by digital technologies is the golfer's digital golfer capabilities score. The average of all the members results in the placement of the golf course on

the Y-axis, which ranges from zero to one hundred. The golf course is now plotted on the model and can be compared to other golf courses or a previous assessment. The same scoring method should be applied when testing the model on different ecosystems; the self-assessment for the value-bringing entity and a step ratio for the value-taking entity. The same axis limits, fifty-six for the value-bringing entity and one hundred for the value-taking entity, should apply.
The model shows the self-assessed scores of both the golfers and the golf clubs. This will show the relation between the two; are they misaligned or even?
The proposed adapted model can be used to assess the current state of digital transformation in the golf ecosystem. This outcome can be used again later to determine growth or change in the ecosystem, or it can be used to explain current innovations and situations in the golf ecosystem.

3.4.11 Generalisable Ecosystemic Digital Technology Transformation Model

As the problem statement in chapter 1.2 first mentioned a more abstract problem, the model proposed could also be generalised over other ecosystems. When following the documented steps explored in this chapter, one would find these steps to be taken. The steps are complemented by examples. An important note is that these given examples, written in italics, are merely examples and have not been researched.

1) Decide the most prominent value-taking entity as the customer of the ecosystem.

   Example: Soccer players in the soccer ecosystem, as they are the ones playing the game.

2) Find the value-bringing entity within the ecosystem that brings the most direct value to the customer.

   Example: Soccer clubs in the soccer ecosystem, as they are the one with the most important direct value line to the soccer players. Taking away the relationship between soccer ball manufacturers but keeping the relationship between the soccer club and the soccer ball manufacturers still allows for the soccer ecosystem to exist. Taking away the relationship between the soccer club and the soccer players will break the ecosystem.

3) Research the customer journey phases of the decided customer, complemented with additional steps.

Example: A soccer player needs to find a soccer club. They need to play at the soccer club. Find the journey by doing research into the ecosystem, or interview entities within the ecosystem (like soccer players) to find the customer journey.

4) Change the digital leadership form to fit the ecosystem that was selected. Have the value-bringing entity fill out that digital leadership form.

   Example: Change any mention of golf club to soccer club, and have someone with the decision-making power, or knowledge, within the soccer club fill out the form.

5) Change the digital capabilities form to fit the customer journey that was found. Have the value-taking entity fill out that digital capabilities form. One could also make the decision to not include any steps or journey phases, but only ask for the number of steps that are taken with digital enhancements.

   Example: Change the customer journey from golfers to soccer players and add some additional (researched) steps as examples.

6) Plot the given results by following the model application or following the scoring documentation in chapter 3.4.10.
7) As an option, one could decide to also include ecosystem specific cosmetic labels. This is up to the creativity of the creator but can also remain the same as in Figure 5.

These steps, complemented by the more elaborate documentation in this chapter, would eventually lead to the same exact results as the model created in this research, but more fitting to the chosen ecosystem.

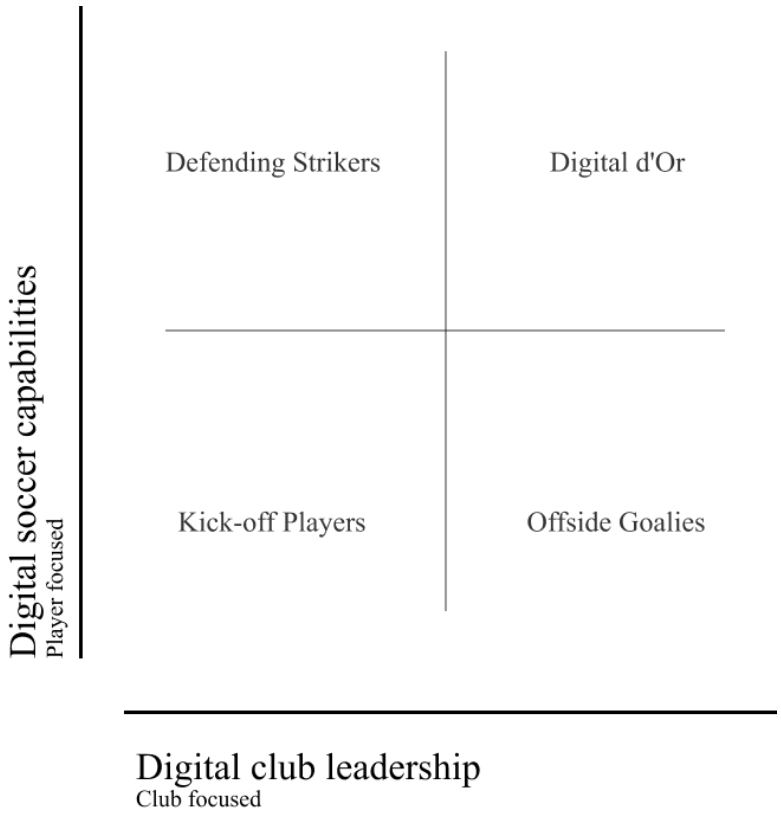

Figure 6: Example of the Ecosystemic Digital Technology Transformation Model for the Dutch soccer ecosystem

Figure 6 shows a rough example of the *Ecosystemic Digital Technology Transformation Model*, specified for the Dutch soccer ecosystem.

3.5 Fifth secondary research question: Ecosystemic digital transformation assessment model applied

In this chapter, the results of the fifth secondary research question; “How is an ecosystemic digital transformation assessment model for the golf ecosystem used in practice?”, will be examined. This secondary research question was conducted through an experiment in an existing ecosystem to align the results of the models to the real-world situation found in said ecosystem. Questionnaires were sent out.

The documentation in this chapter will provide insights for future research, in case one aims to test the model and process on a different ecosystem. The model in this research was tested using a case study surrounding the golf ecosystem in the Netherlands. This chapter will go through refining the questionnaires and scoring the participants, to eventually plot the courses. The same process can and should be followed in order to ensure the best possible validity of the plotting of the model. For the sake of this research, the golf specific model and questionnaires from chapter 3.4 are used.

3.5.1 Initial course questionnaire validation

To validate the questions created in chapter 3.4, and understand the operability of the model, there is a need to test the questionnaires before a more major application.

In ensuring the anonymity of the participants, the contact chain with the golf course that was willing to test the questionnaire has not been included in the research. This golf course was willing to fill out the questionnaire, and provided an opportunity to have a number of golfers fill out the questionnaire in order to validate the questions and the operability of the model. It is important to note that the researcher is personally a member at this golf course. There have not been any interactions concerning this research prior to the email chain eventually providing a respondent to the questionnaire.

As specified in chapter 3.4, the way to plot the golf course is by extracting the answers to the plotting questions. These answers are given to each question on a seven-point scale, corresponding to a score of one to seven. Adding the self-assessment scores together will give the plotting placement of the x-axis of the model.

The golf course willing to validate the model was able to complete the questionnaire. They also answered “no” to the question if anything was difficult to understand or answer, meaning that the golf course questionnaire itself is validated for more extensive use.

Statement	**Score**
The board members of our golf course have a vision for the golf course's digital future.	6
The board members of our golf course share a common vision of digital transformation.	5
It is possible for everyone within our golf course, from players to board members, to join the conversation about the digital transformation of our golf course.	7
Our golf course is open to culture changes to promote digital transformation.	7
Our golf course is investing in the necessary digital skills.	6
Digital initiatives are coordinated by various committees/departments/functions that work together in the process.	2
At our golf course, it is very clearly defined who is responsible for realising digital initiatives and who drives these initiatives.	7
It is clear what digital initiatives need to meet before they are implemented on our golf course.	6
Total score:	46

Table 10: Scores given to each statement question in the golf course self-assessment questionnaire created in chapter 3.4. Questions were translated to English for the sake of this research, original questions as asked to the golf course provided in Appendix C.

As explored in chapter 3.4, the maximum score a golf course can receive based on the answers to the plotting statements is a score of 56 (8 statements, a maximum of 7 points per statement, 56 maximum total score). Looking at Table 10, the answers to the plotting statements of the golf course can be seen. The plotting statements were formulated in chapter 3.4 and are provided in full in Appendix C. Here, they are translated to English, but the statements were asked in Dutch.

Following the plotting guidelines established in chapter 3.4, the golf course testing the questionnaire would be plotted 82.1% on the x-axis (46/56 * 100).

Figure 7: X-axis plot of the golf course testing the questionnaire, with the start being a score of 7, the end being a score of 56 and X marking the placement of the golf course; 46

Figure 7 shows the X-axis plot of the golf course, based on the answers they provided to the golf course questionnaire. The questions asked are listed in Appendix C. The placement on the X-axis was decided by looking at the score the golf course provided on a number of questions based on the self-assessment of Westerman et al. (2014), which were further adapted upon in chapter 3.4

3.5.2 Initial golfer questionnaire validation

To figure out the placement of the golf course on the Y-axis, a golfer questionnaire can be used. As specified in chapter 3.4, the way to plot the golf course is by extracting the answers to the plotting questions. For the Y-axis, this is done by asking the golfer a few questions about their digital use. For a few steps in the golfer journey, golfers are asked to list the steps they take. They are then asked which of those steps are taken with digital technologies. Five respondents were selected at the location of the golf course. They were asked to fill out the questionnaire on paper. Of the five participant golfers, all of them said “no” to the question if anything was difficult to understand or answer, meaning that the golf course questionnaire itself is validated for more extensive use. Of the five participant golfers, none of them provided any other steps other than the golf journey steps provided, which can lead to the conclusion that in this case, no more steps were expected by the participants. Of the five participants, three were able to fill out the questionnaire in a valid and expected manner. Two participants provided more steps in the digital technology questions than they provided in the question leading up to that, which resulted in an invalid result. A way to combat the issues leading up to the invalid answers is to use a digital questionnaire which allows for options to be removed from the list of potential answers if they were not provided in the previous question. With that method, a way to add more options than were previously mentioned is almost eliminated. Only the optional free text field could

yield more invalid responses, so the questions about digital technology are further enhanced and explained. The question: "*In which of these steps are you using digital technologies?*" is changed to further underline the correspondence with the question leading up to it: "*You indicated these steps in the question above. In which of these steps are you using digital technologies?*". The full questions are listed in Appendix B.

Looking at the congregate results of the golfer questionnaires, a plotting of the Y-axis for the golf course can be derived. This can be done by means of looking at the plotting questions of the golfer questionnaire, as created in chapter 3.4. Taking all the steps a golfer has specified to take in a certain phase along the golfer's journey and interaction with the golf course and using that to divide the number of steps the golfer has specified to take with digital technologies, a ratio between total steps and steps taken with digital technology can be created. When taking the average ratio and converting it to a percentage, the placement of the golf course on the Y-axis can be created. In the case of the three valid questionnaires for the golf course willing to participate in the questionnaire, this results in 29.12280702%.

Figure 8: Y-axis plot of the golf course testing the questionnaire, with the start being a score of 0, the end being a score of 100 and Y marking the placement of the golf course; 29.12280702

Figure 8 shows the Y-axis plot of the golf course, based on the answers three of their members provided to the plotting questions in the golfer questionnaire. The questions asked are listed in Appendix B. The placement on the Y-axis was decided by looking at the average ratio of digital use of golfer steps, the questions for which were created in chapter 3.4.

3.5.3 Initial model validation

Using the placement of both the X-axis and the Y-axis of the golf course, deducted from the self-assessment score of the golf course and the average ratio of digital use in steps of golfers, a plot placement of the golf course on the adapted model created and expounded upon in chapter 3.4 can be made.

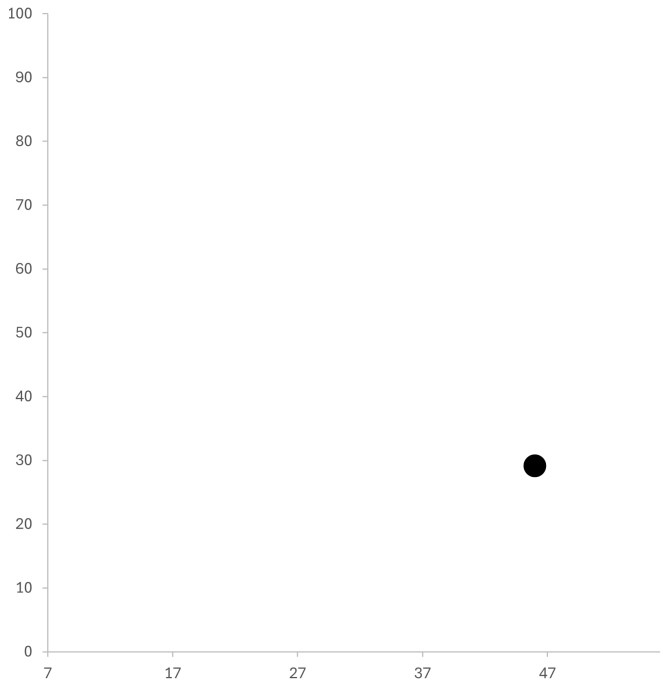

Figure 9: Plot placement of the golf course, based on the self-assessment score of the golf course and the average ratio of digital use in steps of golfers

Figure 9 shows the plot placement of the golf course. The X-axis is based on the score of the self-assessment from chapter 3.4. The Y-axis is based on the average ratio of digital use of members of the golf course. Chapter 3.4 explains the quadrants used, which are direct descendants of those explained by Westerman et al. (2014), which are explored in this research in the theoretical framework chapter 2.3. Because the X-axis placement is above 50% of the total available location, and the Y-axis placement is below 50% of the total available location, the golf course is put in the third quadrant, "Decisive Hawks". It is however, important to note that this placement is preliminary and only meant to test and validate both questionnaires and the adapted model, and are not a means to specify the actual situation or placement of the golf course in the context of this research. There is not enough data to conclude anything, and these responses were meant to test and validate both questionnaires and the adapted model.

3.5.4 Initial insights validation

The golfer questionnaire contains some insight questions with statements relating to feelings surrounding digital technologies in golf that were introduced to the questionnaire in chapter 3.4

after communication with the NGF. As listed in chapter 3.4, golfers were able to fill out their level of agreement with the statement in a scale of five options, relating to a score of one to five. Looking at the scores, an average per translated statement, the original of which are provided in Appendix B, can be deducted for the five respondents: "*I enjoy using digital technologies when playing golf*" results in an average score of 4, which corresponds with the response of "*Somewhat agree*". "*I'm glad that with golf I don't have to use many digital technologies*" results in an average score of 3.2, which corresponds with the response of "*Neutral*". Both "*I would rather play on a golf course where digital technologies are used than one where they are not*" and "*I would rather join a golf club that uses digital technologies than one that does not*" result in an average score of 1.8, which corresponds with the response of "*Somewhat disagree*". Looking at the individual results of the questionnaire, the responses vary greatly between respondents. This leads to the conclusion that these insights questions cannot be used as a general aggregate or explanation to the situation but should rather be used to explain individual outliers as specified before in chapter 3.4.

The golf course questionnaire contains some insight questions with statements relating to the expectation of member feelings surrounding digital technologies in golf and some supporting statements that were introduced to the questionnaire in chapter 3.4 after communication with the NGF. Notably, these answers further support the golf course's efforts to enhance the digital experience and future of the golf course, whilst also denoting their expectation that their members embrace and use digital innovations in their golf game. Whilst the results of this preliminary test of the questionnaires and model cannot be used to make any conclusions, it is notable to state that there is a discrepancy between the golfer responses and the golf course response concerning this topic, as the golf course expects guests and members to value their digital innovations, and states that their guests and members use a lot of digital innovations in their golf game. This is contradictory to the results of the three golfer questionnaires' average ratio in digital use and might also be contradictory to the golfer statements surrounding digital use, be it not that these are concluded to not work in an average or congregate manner and should merely act as a way to explain individual outliers.

3.5.5 Fine-tuning the model

This first test to use and validate the questionnaires and model concluded in a working model and questionnaire for the golf course but left some gaps to be filled for the golfer questionnaire. A new version of the golfer questionnaire was created. To ensure that the selection will be valid, the questionnaire is moved to a digital environment which might prove more logical as answer options can be removed when they were not selected in the question leading up to the options.
Five participants who are members at the golf course that filled out the initial golf course questionnaire filled out the refined online golfer questionnaire. None of these participants noticed any difficulty in understanding or answering the questions. All responses were also expected and valid. Two respondents mentioned an extra option, but none of the respondents mentioned an explicit separate step that was not yet added to the questionnaire.

Figure 10: Y-axis alternate plot of the golf course testing the questionnaire, with the start being a score of 0, the end being a score of 100 and Y marking the placement of the golf course with the refined online questions; 43.27547967

Figure 10 shows the Y-axis plot of the golf course, based on the answers five of their members provided to the plotting questions in the golfer questionnaire. The questions asked are listed in Appendix B. The placement on the Y-axis was decided by looking at the average ratio of digital use of golfer steps, the questions for which were created in chapter 3.4.
Using the placement of both the X-axis and the Y-axis of the golf course, deducted from the self-assessment score of the golf course and the average ratio of digital use in steps of golfers, a plot placement of the golf course on the adapted model created and expounded upon in chapter 3.4 can be made.

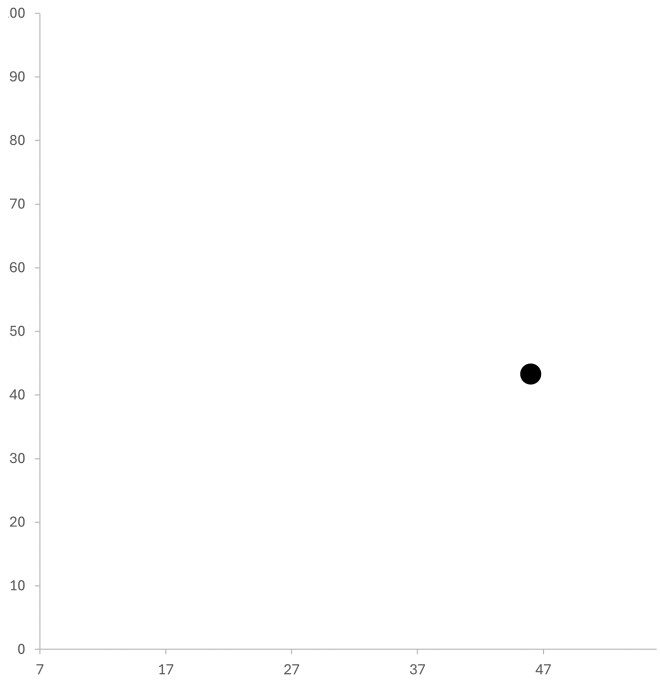

Figure 11: Alternate plot placement of the golf course, based on the self-assessment score of the golf course and the average ratio of digital use in steps of golfers

Figure 11 shows the plot placement of the golf course using the refined online golfer questionnaire. The X-axis is based on the score of the self-assessment from chapter 3.4. The Y-axis is based on the average ratio of digital use of members of the golf course. Chapter 3.4 explains the quadrants used, which are direct descendants of those explained by Westerman et al. (2014), which are explored in this research in the theoretical framework chapter 2.3. Because the X-axis placement is above 50% of the total available location, and the Y-axis placement is below 50% of the total available location, the golf course is put in the third quadrant, “Decisive Hawks”. It is however, important to note that this placement is preliminary and only meant to test and validate both questionnaires and the adapted model, and are not a means to specify the actual situation or placement of the golf course in the context of this research. There is not enough data to conclude anything, and these responses were meant to test and validate both questionnaires and the adapted model.

3.5.6 Final validation

After this initial validation of the golf course questionnaire by the golf course willing to test the questionnaire, the golfer questionnaire by running a local questionnaire and later a refined online version, with also a validation of the validity and workability of the model, a more open selection of golf courses is made. Golf courses within a driving radius of an hour from the university were selected. This hour limit was instituted to ensure a realistic option of attending the golf course in person by the researcher. The selection was made on the basis that the golf course must not be a limited private member golf course, meaning they are allowing non-members to attend and play, they must have an active member base, meaning they are not a green fee only golf course, they must be aligned to a golf club, meaning that just a golf course or golf institute was not sufficient, and that they must have a separate method of contact listed on their website rather than a text form for questions. In total, eight golf courses were contacted, not including the golf course willing to fill out the initial questionnaire.

Three more golf courses filled out the questionnaire, coming to a total of four golf courses. In total, twenty-two golfers filled out the questionnaire. Seven respondents filled out the questionnaire being a member of a golf course which did not fill out a questionnaire themselves. These respondents will be referred to as MISC in the following model interpretation. The golf course willing to fill out the questionnaire first will be referred to as Course A. Then there are three courses left. Course B has four filled out golfer questionnaires and Course C has three corresponding golfer questionnaires. Course D has two responding golfers.

Course	**Total steps**	**Digital steps**	**Step ratio (Ratio between steps and digitally enhanced steps by a golfer, as mentioned in chapter 3.4)**
Course A	15	6	0.4
Course A	26	16	0.615384615
Course A	13	3	0.230769231
Course A	19	10	0.526315789
Course A	23	9	0.391304348

	Course A	Average	43.27547967
Course B	18	6	0.333333333
Course B	12	3	0.25
Course B	9	1	0.111111111
Course B	16	5	0.3125
	Course B	Average	25.17361111
Course C	18	6	0.333333333
Course C	16	5	0.3125
Course C	9	1	0.111111111
	Course C	Average	25.23148148
Course D	20	7	0.35
Course D	17	6	0.352941176
	Course D	Average	35.14705882
MISC	20	7	0.35
MISC	18	5	0.277777778
MISC	17	9	0.529411765
MISC	18	5	0.277777778
MISC	20	10	0.5
MISC	18	6	0.333333333
MISC	22	8	0.363636364
MISC	9	6	0.666666667
MISC	19	6	0.315789474
	MISC	Average	40.15992397

Table 11: Golfer questionnaire data for every golf course

Table 11 shows the data from the golfer questionnaire. The step ratio, as mentioned in chapter 3.4, is calculated per golfer, and the average step ratio is shown per golf course. This can later be used to plot a golf course on the Y-axis. The MISC golfers are not associated with a golf course that has also filled out the questionnaire. This does not mean they are or are not a member of any golf course. Only the online data from Course A is used, the five paper questionnaires are not used in this plot. Two golfers indicated an extra step in one of the phases of the golf journey utilised for the questionnaire that was already present in another phase. These cases would end up with a duplicate step count, which is why those duplicates were reduced to a single step. This is important to note, as it means that a plain statistical quantitative questionnaire is not possible; the researcher must check all the responses of the golfer questionnaire in order to validate the results.

One way to mitigate the response errors of the golfer questionnaire where a golfer prematurely specifies a step is to enable a back button option. This way, golfers can change their answers when they come across a step they have answered before in another step. This back button was introduced, and the questionnaire was sent to six golfers which are included in the MISC course category. None of these golfers specified that they had any difficulty in understanding or answering the questions. It is also important to note that no answering errors were made; none of the golfers specified a step in a journey that should have been in another journey.

Course label	**self-assessment score**
Course A	46
Course B	21
Course C	43
Course D	48

Table 12: Course self-assessment score

Table 12 shows the data from the golf course questionnaire. The combination of this self-assessment score and the average step ratio per golf course shown in Table 11 will be used to plot the golf courses in the model.

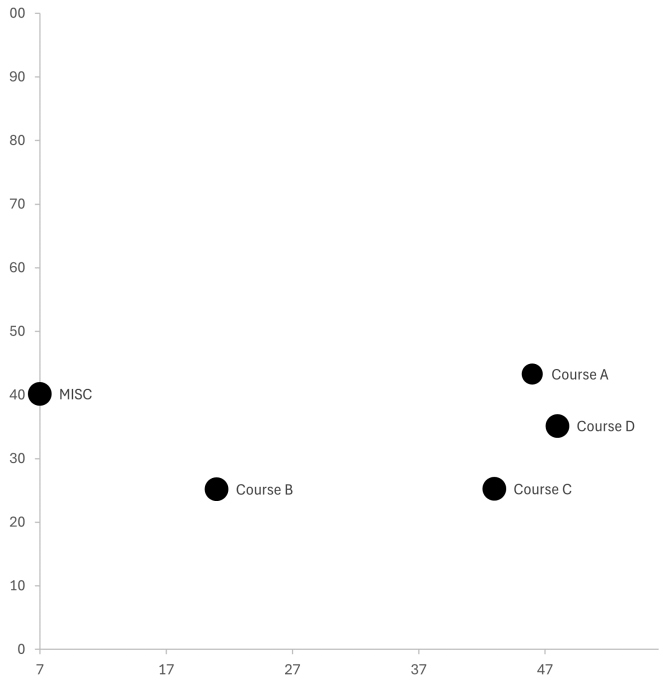

Figure 12: Model plot of every golf course in the research with their associated labels. MISC are the golfers who are not associated with a golf course within this research. MISC is plotted as having a score of 7 to ensure inclusion in the model, but normally would not receive a score.

Figure 12 shows the model with each golf course plotted based on the average step ratio of their golfers and their self assessed score.

3.5.7 Model results

Reintroducing the cosmetic labels from chapter 3.4, a classification of the golf courses can be made.

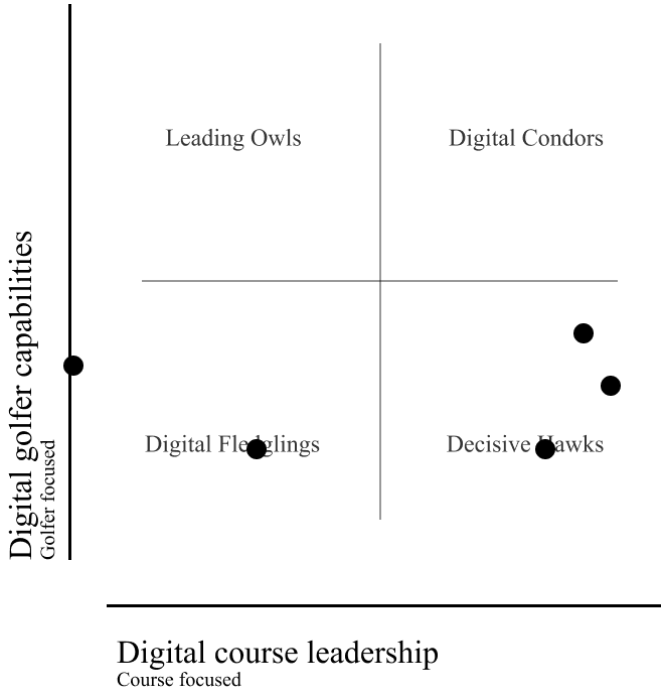

Figure 13: Filled in Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

Figure 13 shows the full model with added cosmetic labels further understanding the placement of the golf courses on the model.

It is important to note that none of the golfers who filled out the questionnaires that were used in the plot mentioned that they had a hard time understanding or filling out the questionnaire. The golf courses also did not indicate any difficulty in filling out the questionnaire. All responses were valid.

Four golf courses filled out an online course focused questionnaire following the research and results of chapter 3.4. Twenty-eight golfers spread out over those four golf courses, including nine independent golfers and five trial questionnaires on paper, filled out a golfer focused questionnaire, also following the research and results of chapter 3.4. Using the results of both questionnaires and chapter 3.4, the golf courses were plotted on the model proposed in this research. The questionnaires were validated through validation questions. The model was validated on its ability to perform plots of courses and their corresponding average member answers. The validation of both questionnaires and the model were successful.

4 Discussion

The research resulted in documentation that eventually led to the creation of the *Ecosystemic Digital Technology Transformation Model*. A set of questionnaire design methods were also devised that are able to score a value-bringing entity within the chosen ecosystem.

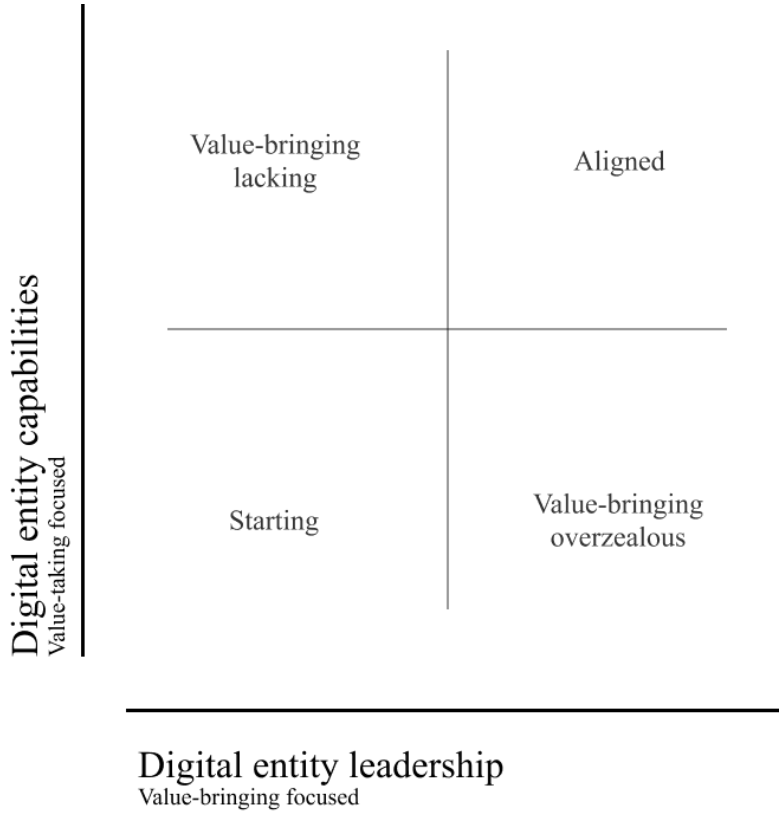

Figure 5: Ecosystemic Digital Technology Transformation Model

The model is intended as a way to spark interest in the actual digital transformation, the opinions and expectations of the customer and the further innovation of digital usage within the ecosystem. The model was not intended to be the actual objective truth, but as a way to ignite the striving to add more knowledge and depth to the digitisation efforts. This is also why the labels are merely cosmetic and do not have purpose other than allowing for creativity to be intertwined with the model. It leaves room for personal choices and changes.

Whilst this research did end up with the *Ecosystemic Digital Technology Transformation Model* that can be altered to create a model to assess the digital transformation for any ecosystem, the

actual research objective revolved around creating and validating such a model for the Dutch golf ecosystem specifically.

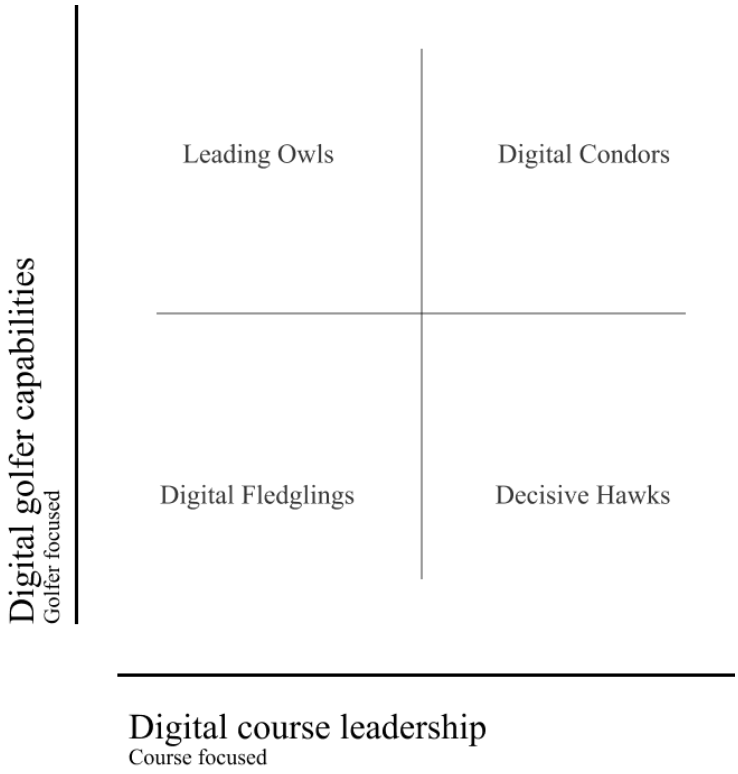

Figure 1: Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

In essence, the questionnaire for the course is left almost the same as the questionnaire by Westerman et al. (2014). This is done to ensure that the results are based on statements made by refined research already conducted by Westerman et al. (2014). Only ecosystem specific references were added that could be changed or removed in other ecosystems. The addition of ecosystem specific changes to the questionnaire can add to the creative freedom one has when altering the questionnaires and model. It can align with the needs and goal of the supposed purpose by speaking to the intended target, in this case the golf course, to make sure the right participants are reached. One could make the argument that no specific changes are needed, and the base of the model and questionnaires does indeed allow for non-specific statements as created by Westerman et al. (2014), yet the more specific information that is added the more valuable and trustworthy the results can be as it can strengthen the possibility that the intended target is reached. Adding the word “golf course” in this case could eliminate the possibility that

digital handicap registration organisations, like the ANWB Golf (2024) registration that does not pertain to any physical golf courses, also feel as the intended target. Having a non-physical golf course, in the case of the ANWB Golf (2024) example, fill out the questionnaire would mean that a registration only organisation would fill out a questionnaire meant for entities with actual decision-making consequences that speak to the course's ability to maintain and attract golfers based on their digital strategies. The IT department statements were removed, as it is not expected from every entity to have their own IT department. The questionnaire for the golfer contains a ratio of digital usage per step, as they themselves might not have a complete digital strategy, or a personal objective to reach in digitisation. The researcher might also decide to not include steps, but ask for the ratio directly, or they might decide to interview participants and extract the ratio themselves from the questions.

The internal validity remained as the passage of time was no longer an issue; as specified in chapter 3.1 and later used in chapter 3.4, the model choice was meant as a snapshot. It is therefore expected that the model's usage would change over time. Another threat was the possibility of drawing the wrong relationships. An aspect as to why this was not a major hurdle, was the limit of relationships needed for the model to function; a single relationship between the most important value-taking and value-bringing entities was needed. Research was done to uncover this, in the form of literature review and interviews. The external validity was kept as a result of specifying the research and only testing the model and the questionnaires rather than assuming conclusions from the testing data. The construct validity was retained by having participants answer questions, not having them fill out their own positioning. The sampling size was put up to validate the model, but no conclusions to the state of the ecosystem were drawn. By adding clear documentation and steps, another researcher can validate the response and entire research, as to validate the reliability of the research.

The difference between the *Ecosystemic Digital Technology Transformation Model* and the *Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem* is in the specific ecosystem: The *Ecosystemic Digital Technology Transformation Model* is the model that this research proposes in chapter 3.4. The *Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem* is that same model but specified for the Dutch golf ecosystem. The questions in the questionnaire are specific to the golf ecosystem, as are the cosmetic labels.

One could use the proposed *Ecosystemic Digital Technology Transformation Model* for other ecosystems by following the steps in chapter 3.4.11. If one does not add the cosmetic labels specified in chapter 3.4.11, the model itself is not specific to an ecosystem. The questionnaires might be. However, that is also up to the researcher, as specified in chapter 3.4.11. As long as one is able to follow the steps proposed in chapter 3.4.11, the model and questionnaires can be altered and used for any ecosystem.

As seen in chapter 3.4.11, the questionnaire for the most prominent value-bringing entity is not very ecosystem specific. One could change the mention of a golf club to just "decision making components", or something that fits their needs. As the questionnaire for the main value-taking customer ends up with a step ratio (the number of steps that are done using digital technologies), one could also just ask the question: "*How many of your steps do you take and how many do you take with digital technologies?*". These two options do result in a way in which the questionnaires are no longer ecosystem specific but might be less trustworthy as someone might understand the definition of steps different to other participants. The insights questions can also be altered to fit the needs of the governing body or any stakeholders requesting the model but are not needed to execute this research or the intended model.

The participants that are plotted can note their position compared to their peers. This way, they can notice that they are behind or in front compared to others in terms of digital transformation. Because the model introduces the point of view from the customer, a participant (in this case, golf clubs) that was plotted can see if their expectations concerning their digital strategy aligns with that of the customers.

A comparison in the spread of the entities, or the alignment between value-taking and value-bringing entities can definitely be made. The model was meant as a relative assessment between value-taking and value-bringing entities within the same ecosystem. Comparing the spread and alignment between ecosystems is possible, as those are not ecosystem specific. Comparing the actual scoring, or quadrant placement, is less trustworthy as the assessment is a self-reflection by the participants and the step ratio by the value-taking entity might contain more or less steps than other ecosystems.

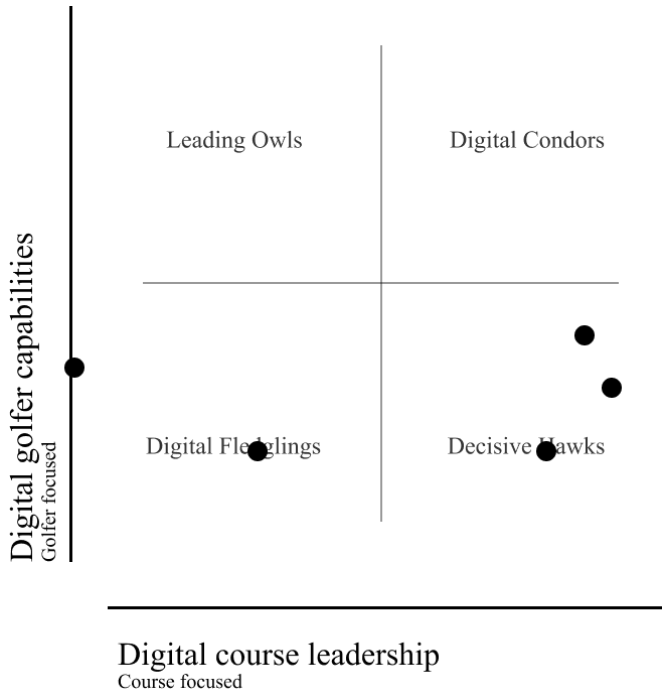

Figure 13: Filled in Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

Looking at the fully plotted model within the Dutch golf ecosystem, it is noticeable that there is a slight misalignment between the X-axis, the golf course, and the Y-axis, the golfer. The participating golfers had a lower step ratio than what their corresponding golf courses scored on the digital strategy statements. This could mean that the golf courses are misaligned to their customers, or that their customers are not yet ready for the expected changes caused by the digital strategy. Overall, concerning the ecosystem, one could find that the golf ecosystem itself is slightly misaligned, as the overall spread is high and the distance between golfers and golf clubs is noticeable. The results of this research concerning the plotting of golf clubs in the Dutch golf ecosystem were however meant to validate and test the proposed model and questionnaires. There are too few respondents to make concrete conclusions surrounding the state of digital transformation within the Dutch golf ecosystem.

5 Conclusion

This research explored digital transformation within the Dutch golf ecosystem and aimed to understand a method with which one could assess the current rate and range of digital transformation. Following the problem statement created in chapter 1.2: “The NGF lacks the inherent ability to efficiently and effectively assess digital transformation within the golf ecosystem”, a set of secondary research questions was created to offer a solution to the problem statement.

Starting with a literature review to understand digital transformation assessment in chapter 3.1, the first secondary research question: “How is digital transformation assessed?”, explored the definition of digital transformation, the rationale behind it and the inherent need to assess and grow it, and found multiple characteristics for the successful transformation and assessment of digitisation within organisations. Keywords were made and searched for within applicable papers. To retrieve papers, a snowballing technique was used. The papers resulted in common themes and a literature analysis was performed, ultimately exploring what makes a good method to assess digital transformation and the characteristics of digital transformation and digitisation, which could be used as a solid base by subsequent secondary research questions. The first secondary research question found important characteristics of digital transformation, such as the fact that digital transformation represents a fundamental change through the application of digital technology, significantly impacting all sectors and altering business operations and value creation. While digitisation and digitalisation focus on technology, digital transformation prioritises the customer, making the customer journey and satisfaction key to digital maturity. Maturity models aim to assess a company‘s positioning and as-is situation, define and systematise improvement initiatives and navigate through the evolutionary process. Various methods, models, and frameworks are available to gauge an organisation's digital maturity through questions about its strategy and current state.

A literature review pointed out the definitions for an ecosystem, an entity and the concept of centralisation within the scope of this research in chapter 3.2 with the second secondary research question: “What are ecosystems, entities and centralisation?”. Keywords were made and searched for within applicable papers. To retrieve papers, a snowballing technique was used. The papers resulted in common themes and a literature analysis was performed. The second secondary research question found an ecosystem to be a collection of loosely connected

networks of entities, jointly creating value through interdependent interactions. It found an entity to be any active value-bringing participant in an ecosystem. Under the concept of centralisation, it understood the concentration of decision-making power and authority at a central point within an organisation or system.

The third secondary research question held semi structured interviews with entities within the Dutch golf ecosystem marked as leaders by the NGF. Important conclusions were drawn from the interviews that were used to create the model and base for the case study to be executed in subsequent secondary research questions. The third secondary research question found that golf had been slower to embrace digital solutions compared to other sports. It also found that, in terms of digital innovation, golf in the Netherlands was leading other European countries whilst being behind the transformation in the USA. It found golf to be a conservative sport, being resistant to the upcoming changes concerning golf rollback rules, and found golf courses to be traditional, hesitant and somewhat arrogant. There is a noticeable shift, making golf more enjoyable. One innovation that could be the cause is the use of gamification, now being used more and more by golf courses, which attracts a younger audience. That is precisely the audience the NGF seeks, compared to their current, older demographic.

Just before the model use and testing, the fourth secondary research question used information surfaced by the other secondary research questions and personal contact with the NGF and communication experts in a secondary analysis to evolve an existing model to fit a solution to the proposed problem statement of this research. "How is digital transformation in the golf ecosystem assessed?" deducted information from multiple sources to change the four levels of digital mastery by Westerman et al. (2014) that was explored in chapter 2.3.

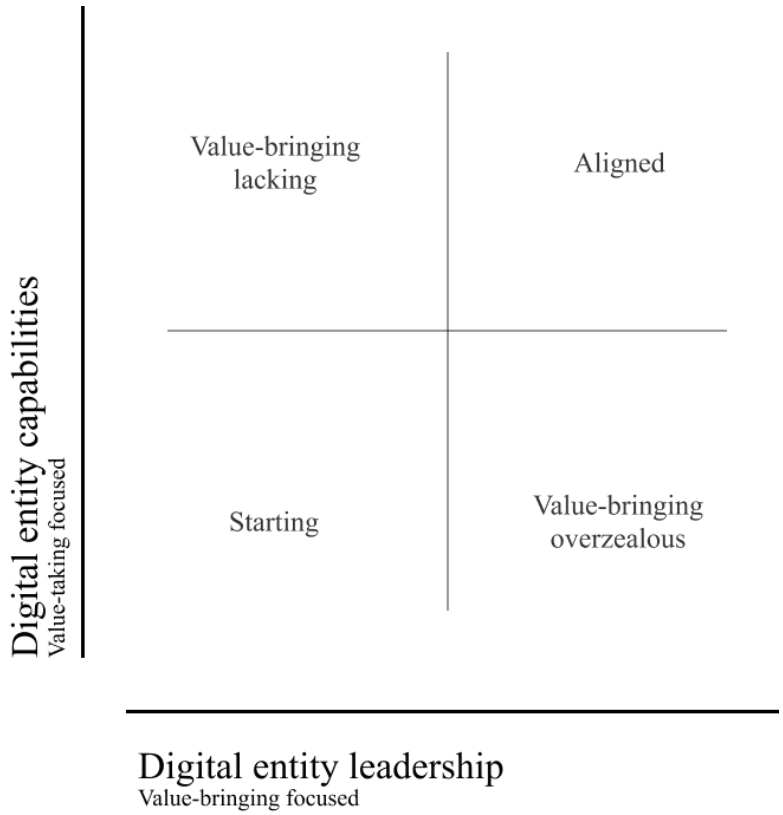

Figure 5: Ecosystemic Digital Technology Transformation Model

Within the fourth secondary research question, a base ecosystemic digital technology transformation model was created, as shown in Figure 5.

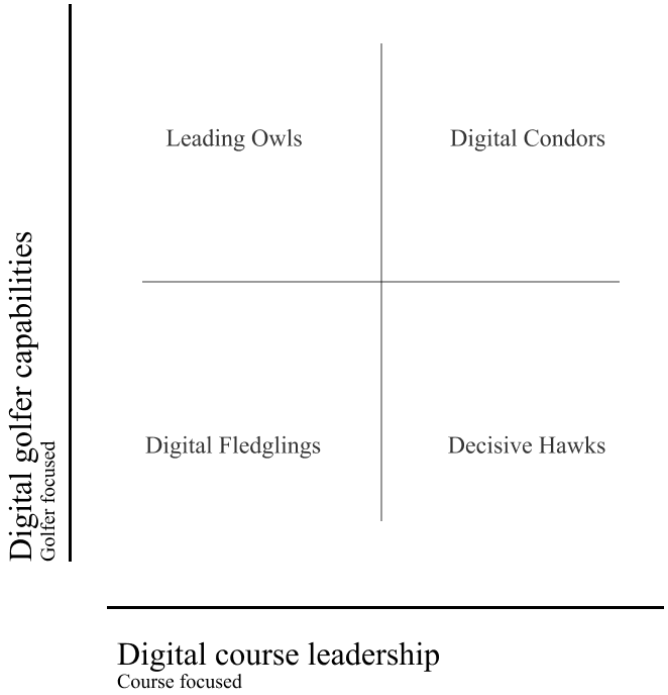

Figure 1: Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

Eventually, a golf specific version of this model was created, as shown in Figure 1.

Ending the secondary research questions with an experiment in an existing ecosystem to align the results of the models to the real-world situation found in said ecosystem, the fifth secondary research question: “How is an ecosystemic digital transformation assessment model for the golf ecosystem used in practice?”, sent out questionnaires to golfers and golf clubs. With a paper trial of one golf course and five golfers, some changes to the questionnaires were made. After the changes, more golfers and golf clubs were asked to participate.

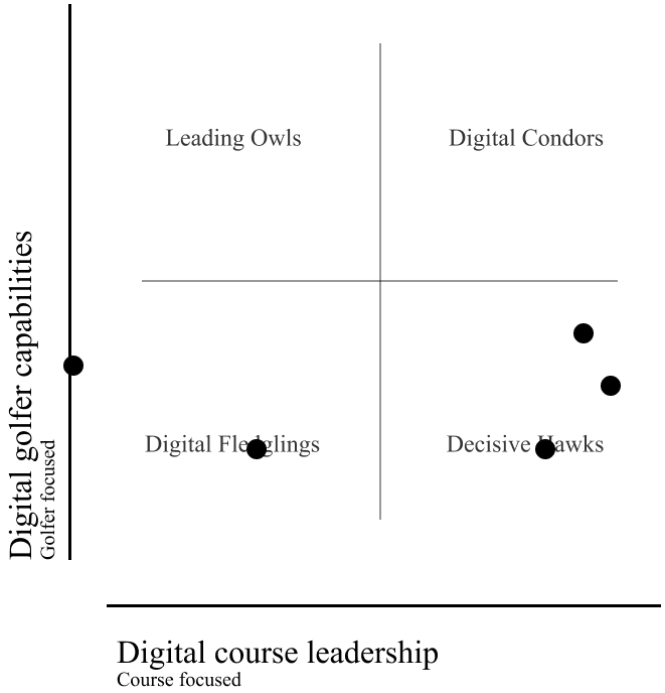

Figure 13: Filled in Ecosystemic Digital Technology Transformation Model for the Dutch golf ecosystem

In total, a response of twenty-three golfers and four golf clubs led to the successful completion and validation of the questionnaires and the model. The model was filled in, as shown in Figure 13.

Using the results of the secondary research questions, in conjunction with the information in the preliminary chapters, the results to the primary research question can be explored.

"How can the governing body in the golf ecosystem assess digital transformation of that ecosystem?".

The governing body in the golf ecosystem should make use of the ecosystemic digital transformation assessment model proposed by this research, shown in Figure 1. The governing body in the golf ecosystem should ask golf courses to fill out a questionnaire, which has been created after extensive research. Either the governing body or the golf course should reach out to their golfing members to fill out a golfer questionnaire, which has also been created after extensive research. The results of both questionnaires can be examined, and after validation be

used to plot the golf course on the proposed ecosystemic digital transformation assessment model. After all golf courses are plotted, a direct relation to the golf course and their members can be drawn, as can relations between the states of digital transformation between different golf courses be observed. The model can show the governing body the current state of digital transformation within the ecosystem. The model can also be used in a temporal fashion in which the governing body explores the ecosystem with the proposed ecosystemic digital transformation assessment model at different times to view changes with the state of digital transformation within the ecosystem, to compare the differences and see the rate and range of digital transformation within the ecosystem.

6 Limitations and future research

6.1 Limitations

6.1.1 Generalisability of results to a greater audience

Generalisability of the results to a greater audience can be viewed as a limitation of the research. Whilst the questionnaires and model are able to scale to use, the results that were found in this research are not meant to be taken as truth; they act merely as support and validation of the questionnaires, model and research process rather than results applicable to the golf ecosystem. With a total of twenty-eight golfer questionnaires, five of which were made on paper, and four golf club questionnaires, the model, questionnaires and process were validated, as was the goal mentioned in chapter 1.2 and chapter 1.4. The results however, should not be taken as truth within the Dutch golf ecosystem.

6.1.2 Temporal changes

Temporal changes in ecosystems are a type of change that will occur over a certain period of time (TEMPORAL CHANGES OF ECOSYTEMS | Principlesof-ecology, n.d.). In chapter 3.1, it was found that a model is an abstract copy of reality (Gollhardt et al., 2020). It is therefore understandable that the results of a model can differ in the future, or previous results do not hold in current time. One of the challenges of developing a model that assesses digital transformation in an ecosystem, is that the ecosystem might change over time. This does not only affect the results, but might have an effect on the actual workings of the model. A limitation of this research is not trialling the model over a certain timeframe, but rather taking itself as a snapshot, not only the results.

6.1.3 Subjective assessment

The results are based on the self assessed scores of both golfers and golf clubs. Because the golfers and golf clubs are able to provide their own assessment, the assessment can be viewed as subjective. As specified in chapter 3.4, the results between the golfers and the golf club are however meant to show a relation between the two. It can be used to check misalignment, but was never meant as a sole truth to the actual position.

6.2 Future research

6.2.1 Greater audience

Future research might want to examine the results of a greater audience using the model. This research can further validate the questionnaires and models and it might be able to create a snapshot of the Dutch golf ecosystem, which in turn can be used in subsequent research.

6.2.2 Introduction of other entities

One thing mentioned in chapter 3.4, is that it was chosen to include only the golfer and golf clubs, based on research from chapters 3.1 and 3.2. A very interesting addition to the research would be to include other entities in the findings and results of the model. This way, a more complete overview of the ecosystem can be created rather than a snapshot of the bare minimum. One way to achieve this, would be to extend the dimensions of the model to fit new entities.

6.2.3 Ecological changes in model

One very interesting take from chapter 3.3, is that the Dutch golf market, in some cases, is leading in terms of digital transformation compared to other European countries (Appendix E, 10:24. Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)). It would be tremendously enticing to include other countries in the results of the model. Both to validate and get results that can be compared to the Dutch golf ecosystem to understand differences and provide evidence to that claim.

6.2.4 Ecosystemic changes in model

This research was explicitly focused on the golf ecosystem. One interesting change that future research might be able to do, is the introduction of other ecosystems. It would be very interesting to see that the model can also be validated in other sports, or later on in entirely different aspects of society. Whilst the model is very much altered to fit the golf ecosystem, the research practice and steps could in theory be followed for any other ecosystem.

7 Bibliography

7.1 References

Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. Strategic Management Journal, 31(3), 306-333. https://doi.org/10.1002/smj.821

Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. Journal of Management, 43(1), 39-58. https://doi.org/10.1177/0149206316678451

Alekseevna, T. E., Yakovlevna, R. E., & Vasilievich, R. D. (2017, October 2-4). The concept of digital transformation of the society. In 2017 Tenth International Conference Management of Large-Scale System Development (MLSD) (pp. 1-5). IEEE. https://doi.org/10.1109/MLSD.2017.8109697

Alonso, R., Dessein, W., & Matouschek, N. (2012). When Does Adaptation Require Decentralization? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2050134

Andrews, R., Boyne, G. A., Law, J., & Walker, R. M. (2009). Centralization, organizational strategy, and public service performance. Journal of Public Administration Research and Theory, 19(1), 57–80. https://doi.org/10.1093/jopart/mum039

Arnold, U. (1999). Organization of global sourcing: Ways towards an optimal degree of centralization. European Journal of Purchasing & Supply Management, 5(3–4), 167-174. https://doi.org/10.1016/S0969-7012(99)00023-4

Baca, A., & Kornfeind, P. (2006). Rapid feedback systems for elite sports training. IEEE Pervasive Computing, 5(4), 70-76. https://doi.org/10.1109/MPRV.2006.82

Battistella, C., Colucci, K., De Toni, A., & Nonino, F. (2012). Methodology of Business Ecosystems Network Analysis: A case study in Telecom Italia Future Centre. Technological Forecasting and Social Change, 80. https://doi.org/10.1016/j.techfore.2012.11.002

Bellantuono, N., Nuzzi, A., Pontrandolfo, P., & Scozzi, B. (2021). Digital Transformation Models for the I4.0 Transition: Lessons from the Change Management Literature. Sustainability, 13(23), 12941. https://doi.org/10.3390/su132312941

Berman, S. (2012). Digital transformation: Opportunities to create new business models. Strategy and Leadership, 40(2), 16-24. https://doi.org/10.1108/10878571211209314

Bharadwaj, Anandhi and El Sawy, Omar A. and Pavlou, Paul A. and Venkatraman, N. Venkat, Digital Business Strategy: Toward a Next Generation of Insights (June 1, 2013). MIS Quarterly (2013), 37 (2), 471-482, Available at SSRN: https://ssrn.com/abstract=2742300

Biondi, Y. (2005). The firm as an entity: Management, organization, accounting. Universita degli Studi di Brescia Working Paper, (No. 46). Retrieved from SSRN: https://ssrn.com/abstract=774764 10.2139/ssrn.774764

Bogers, M., Sims, J., & West, J. (2019). What is an ecosystem? Incorporating 25 years of ecosystem research. Academy of Management Proceedings, 2019(1). Available at SSRN: https://ssrn.com/abstract=3437014 or http://dx.doi.org/10.2139/ssrn.3437014

Borgh, M., Cloodt, M., & Romme, G. (2012). Value creation by knowledge-based ecosystems: Evidence from a field study. R&D Management, 42(2), 150-169. https://doi.org/10.1111/j.1467-9310.2011.00673.x

Bouquet, P., Stoermer, H., Niederee, C., & Maña, A. (2008). Entity Name System: The back-bone of an open and scalable web of data. In Proceedings of the 2008 International Conference on Semantic Computing (pp. 554-561). https://doi.org/10.1109/ICSC.2008.37

Burton-Jones, A., Akhlaghpour, S., Ayre, S. J., Barde, P., Staib, A., & Sullivan, C. (2020). Changing the conversation on evaluating digital transformation in healthcare: Insights from an institutional analysis. Information & Organization, 30, 100255. https://doi.org/10.1016/j.infoandorg.2019.100255

Butt, J. (2020). A conceptual framework to support digital transformation in manufacturing using an integrated business process management approach. Designs, 4(3), 17. https://doi.org/10.3390/designs4030017

Carter, N., & Cullen, J. (1984). A comparison of centralization/decentralization of decision making: Concepts and measures. Journal of Management, 10(2), 259-268. https://doi.org/10.1177/014920638401000211

Ceron-Anaya, H. (2010). An approach to the history of golf: Business, symbolic capital, and technologies of the self. Journal of Sport and Social Issues, 34(3), 339-358. https://doi.org/10.1177/0193723510377317

Chang, M. H., & Harrington, J. E. (2000). Centralization vs. decentralization in a multi-unit organization: A computational model of a retail chain as a multi-agent adaptive system. Management Science, 46(11), 1427-1440. https://doi.org/10.1287/mnsc.46.11.1427.12085

Chen, Y., Jaw, Y., & Wu, B. (2016). Effect of digital transformation on organizational performance of SMEs: Evidence from the Taiwanese textile industry's web portal. Internet Research, 26(1), 186-212. https://doi.org/10.1108/intr-12-2013-0265

Claes Wohlin. 2014. Guidelines for snowballing in systematic literature studies and a replication in software engineering. In Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering (EASE '14). Association for Computing Machinery, New York, NY, USA, Article 38, 1–10. https://doi.org/10.1145/2601248.2601268

Cosh, A., Fu, X., & Hughes, A. (2012). Organization structure and innovation performance in different environments. Small Business Economics, 39, 1–17. https://doi.org/10.1007/s11187-010-9304-5

van Dijk, J. A. G. M. (2006). Digital divide research, achievements and shortcomings. Poetics, 34(4–5), 221-235. https://doi.org/10.1016/j.poetic.2006.05.004

Dikhanbayeva D, Shaikholla S, Suleiman Z, Turkyilmaz A. Assessment of Industry 4.0 Maturity Models by Design Principles. Sustainability. 2020; 12(23):9927. https://doi.org/10.3390/su12239927

Earley, S. (2014). The digital transformation: Staying competitive. IT Professional, 16(4), 58-60. https://doi.org/10.1109/mitp.2014.24

Feliscuzo, L., Larmie, & Celbert, Himang. (2011). Library Periodical Indexing Software Evaluation using the Unified Theory of Acceptance and Use of Technology. Procedia - Social and Behavioral Sciences, 25, 104-114. https://doi.org/10.1016/j.sbspro.2011.10.532

Fu, H., Xiao, X.-H., & Zhu, H.-M. (2024). Big gains in digital ecosystem niches: How facilitators emerge and develop into an organizational category. Information & Management, 61, 103957. https://doi.org/10.1016/j.im.2024.103957

Furjan, M. T., Strahonja, V., & Tomičić-Pupek, K. (2018). Framing the digital transformation of educational institutions. In Central European Conference on Information and Intelligent Systems (pp. 97-104). Faculty of Organization and Informatics Varazdin. https://api.semanticscholar.org/CorpusID:169068603

Gollhardt, T., Halsbenning, S., Hermann, A., Karsakova, A., & Becker, J. (2020). Development of a Digital Transformation Maturity Model for IT Companies. 2020 IEEE 22nd Conference on Business Informatics (CBI), 1, 94-103.

Gong, C., & Ribiere, V. (2021). Developing a unified definition of digital transformation. Technovation, 102, Article 102217. https://doi.org/10.1016/j.technovation.2020.102217

Govindarajan, V. (1986). Decentralization, strategy, and effectiveness of strategic business units in multibusiness organizations. Academy of Management Review, 11(4), 844-856. https://doi.org/10.5465/amr.1986.4284099

Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. Technovation, 90–91, 102098. https://doi.org/10.1016/j.technovation.2019.102098

Gray, J., & Rumpe, B. (2017). Models for the digital transformation. Software & Systems Modeling, 16(3), 307-308. https://doi.org/10.1007/s10270-017-0596-7

Gölzer, P., & Fritzsche, A. (2017). Data-driven operations management: Organisational implications of the digital transformation in industrial practice. Production Planning & Control, 28(16), 1332-1343. https://doi.org/10.1080/09537287.2017.1375148

Hage, J., & Aiken, M. (1967). Relationship of centralization to other structural properties. Administrative Science Quarterly, 12(1), 72-92. https://doi.org/10.2307/2391213

Hassell, J., Aleman-Meza, B., & Arpinar, I. (2006). Ontology-driven automatic entity disambiguation in unstructured text. In J. Davies, R. Studer, & P. Warren (Eds.), LNCS: Lecture Notes in Computer Science (Vol. 4273, pp. 44-57). Springer. https://doi.org/10.1007/11926078_4

den Hartigh, E., & Asseldonk, A. G. M. (2004). Business ecosystems: A research framework for investigating the relation between network structure, firm strategy, and the pattern of innovation diffusion. In F. van Eijnatten (Ed.), Proceedings of the European Chaos/Complexity in Organisations Network (ECCON 2004) annual meeting (pp. 1-38).

Heaton, J. (2008). Secondary analysis of qualitative data: an overview. Historical Social Research, 33(3), 33-45. https://doi.org/10.12759/hsr.33.2008.3.33-45

Heilig, L., Schwarze, S., & Voss, S. (2017). An analysis of digital transformation in the history and future of modern ports. https://doi.org/10.24251/HICSS.2017.160

Helfat, C. E., & Raubitschek, R. S. (2018). Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems. Research Policy, 47(8), 1391-1399. https://doi.org/10.1016/j.respol.2018.01.019

Herbert, I. (2009). Business transformation through empowerment and the implications for management control systems. Journal of Human Resource Costing & Accounting, 13(3), 221-244. https://doi.org/10.1108/14013380910995511

Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2020). Options for formulating a digital transformation strategy. (pp. 151-173). Routledge. https://doi.org/10.4324/9780429286797-7

Hess T., Benlian A., Matt C., Wiesböck F. (2016). Options for formulating a digital transformation strategy. MIS Quarterly Executive, 15(2), 123–139

Hinings, B., Gegenhuber, T., & Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. Information & Organization, 28(1), 52-61. https://doi.org/10.1016/j.infoandorg.2018.02.004

Hodge, C. M., & Narus, S. P. (2018). Electronic problem lists: A thematic analysis of a systematic literature review to identify aspects critical to success. Journal of the American Medical Informatics Association, 25(5), 603-613. https://doi.org/10.1093/jamia/ocy011

Issa, A., Hatiboglu, B., Bildstein, A., & Bauernhansl, T. (2018). Industrie 4.0 roadmap: Framework for digital transformation based on the concepts of capability maturity and alignment. Procedia CIRP, 72, 973-978. https://doi.org/10.1016/j.procir.2018.03.151

Jacobides, M., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. Strategic Management Journal, 39. https://doi.org/10.1002/smj.2904

Jacoby, J., & Matell, M. S. (1971). Three-Point Likert Scales Are Good Enough. Journal of Marketing Research, 8(4), 495-500. https://doi.org/10.1177/002224377100800414

Kapoor, R., & Lee, J. (2010). Coordinating and competing in ecosystems: How organizational forms shape new technology investments. Strategic Management Journal, 34. https://doi.org/10.2307/23362657

Kitchenham, Barbara. (2004). Procedures for Performing Systematic Reviews. Keele, UK, Keele Univ.. 33.

Kraus, S., Jones, P., Kailer, N., Weinmann, A., Chaparro-Banegas, N., & Roig-Tierno, N. (2021). Digital transformation: An overview of the current state of the art of research. SAGE Open, 11(3). https://doi.org/10.1177/21582440211047576

Kääriäinen, J., Pussinen, P., Saari, L., Kuusisto, O., Saarela, M., & Hänninen, K. (2020). Applying the positioning phase of the digital transformation model in practice for SMEs: Toward systematic development of digitalization. International Journal of Information Systems and Project Management. https://doi.org/10.12821/ijispm080402

Lames, M., & McGarry, T. (2007). On the search for reliable performance indicators in game sports. International Journal of Performance Analysis in Sport, 7(1), 62-79. https://doi.org/10.1080/24748668.2007.11868388

Leach, R. J., Forrester, S. E., Mears, A. C., & Roberts, J. R. (2017). How valid and accurate are measurements of golf impact parameters obtained using commercially available radar and stereoscopic optical launch monitors? Measurement, 112, 125-136. https://doi.org/10.1016/j.measurement.2017.08.009

Lee, J. (2021). Factors influencing golfers' intention to use a direct booking website (Doctoral dissertation, University of Nevada, Las Vegas). https://digitalscholarship.unlv.edu/thesesdissertations/4166/ https://doi.org/10.34917/25374057

Lehmann, D. R., & Hulbert, J. (1972). Are Three-Point Scales Always Good Enough? Journal of Marketing Research, 9(4), 444-446. https://doi.org/10.1177/002224377200900416

von Leipzig, T., Gamp, M., Manz, D., Schöttle, K., Ohlhausen, P., Oosthuizen, G., Palm, D., & von Leipzig, K. (2017). Initialising customer-orientated digital transformation in enterprises. Procedia Manufacturing, 8, 517-524. https://doi.org/10.1016/j.promfg.2017.02.066

Liebermann, D. G., Katz, L., Hughes, M. D., Bartlett, R. M., McClements, J., & Franks, I. M. (2002). Advances in the application of information technology to sport performance. Journal of Sports Sciences, 20(10), 755–769. https://doi.org/10.1080/026404102320675611

Limani, Y., Hajrizi, E., Stapleton, L., & Retkoceri, M. (2019). Digital transformation readiness in higher education institutions (HEI): The case of Kosovo. IFAC-PapersOnLine. https://doi.org/10.1016/j.ifacol.2019.12.445

Lu, C., Rong, K., You, J., & Shi, Y. (2014). Business ecosystem and stakeholders' role transformation: Evidence from Chinese emerging electric vehicle industry. Expert Systems with Applications, 41, 4579–4595. https://doi.org/10.1016/j.eswa.2014.01.026

Magesa, M., & Jonathan, J. (2020). Digital leadership for digital transformation. Retrieved from https://www.researchgate.net/publication/367204353_Digital_Leadership_for_Digital_Transformation

Mahlow, C., & Hediger, A. (2019). Digital transformation in higher education—Buzzword or opportunity? eLearn, 2019. https://doi.org/10.1145/3329488/3331171

Malik, H. H., MacGillivray, I., Olof-Ors, M., Sun, S., & Saroha, S. (2011). Exploring the corporate ecosystem with a semi-supervised entity graph. In Proceedings of the 20th ACM international conference on Information and knowledge management (pp. 1857–1866). https://doi.org/10.1145/2063576.2063844

Majchrzak, A., Markus, M. L., & Wareham, J. (2016). Designing for digital transformation: Lessons for information systems research from the study of ICT and societal challenges. MIS Quarterly, 40(2), 267–277. https://doi.org/10.25300/MISQ/2016/40:2.03

Marks, A., & Al-Ali, M. (2022). Digital transformation in higher education: A framework for maturity assessment. In A. A. Ojo & G. A. Reynolds (Eds.), COVID-19 challenges to university information technology governance (pp. 61-81). Springer International Publishing. https://doi.org/10.1007/978-3-031-13351-0_3

Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. Business & Information Systems Engineering, 57(6), 339-343. https://doi.org/10.1007/s12599-015-0401-5

Mears, A., Phillips, I., & Sumner, J. (2019). Investigating the perceived effectiveness of digital technology for elite athlete support in golf. In Proceedings of the 7th International Conference on Sport Sciences Research and Technology Support (icSPORTS 2019) (pp. 190–197). https://doi.org/10.5220/0008347501900197

Morakanyane, R., Grace, A., & O'Reilly, P. (2017). Conceptualizing digital transformation in business organizations: A systematic review of literature. https://doi.org/10.18690/978-961-286-043-1.30

Nadkarni, S., & Prügl, R. (2021). Digital transformation: A review, synthesis and opportunities for future research. Management Review Quarterly, 71, 233–341. https://doi.org/10.1007/s11301-020-00185-7

Nasution, R.A., Arnita, D., Rusnandi, L.S.L., Qodariah, E., Rudito, P. & Sinaga, M.F.N. (2020), "Digital mastery in Indonesia: the organization and individual contrast", Journal of Management Development, Vol. 39 No. 4, pp. 359-390. https://doi.org/10.1108/JMD-03-2019-0081

Negandhi, A. R., & Reimann, B. C. (1973). Task environment, decentralization and organizational effectiveness. Human Relations, 26(2), 203-214. https://doi.org/10.1177/001872677302600206

Oc, Y., & Toker, A. (2022). An acceptance model for sports technologies: The effects of sports motivation, sports type, and context-aware characteristics. International Journal of Sports Marketing and Sponsorship, 23(4), 785-803. https://doi.org/10.1108/ijsms-03-2021-0060

Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2022). Tackling the digitalization challenge: How to benefit from digitalization in practice. International Journal of Information Systems and Project Management. https://doi.org/10.12821/ijispm050104

Paulus-Rohmer, D., Schatton, H., & Bauernhansl, T. (2016). Ecosystems, strategy and business models in the age of digitization—How the manufacturing industry is going to change its logic. Procedia CIRP, 57, 8-13. https://doi.org/10.1016/j.procir.2016.11.003

Petrović, L.T., Milovanović, D. and Desbordes, M. (2015), "Emerging technologies and sports events: Innovative information and communication solutions", Sport, Business and Management, Vol. 5 No. 2, pp. 175-190. https://doi.org/10.1108/SBM-06-2012-0021

Pihir, I., Tomičić-Pupek, K., & Furjan, M. T. (2018). Digital transformation insights and trends. In Proceedings of the Central European Conference on Information and Intelligent Systems (pp. 141-149). Faculty of Organization and Informatics Varazdin. https://www.proquest.com/openview/116cd2cc0df0317959a2970ad5d2bdaa/1?pq-origsite=gscholar&cbl=1986354

Rautenbach, W. J., Kock, I. H., & Jooste, J. L. (2019). The development of a conceptual model for enabling a value-adding digital transformation: A conceptual model that aids organisations in the digital transformation process. In 2019 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC) (pp. 1-10). https://doi.org/10.1109/ice.2019.8792675

Richardson, H., Vandenberg, R., Blum, T., & Roman, P. (2002). Does decentralization make a difference for the organization? An examination of the boundary conditions circumscribing decentralized decision-making and organizational financial performance. Journal of Management, 28(2), 217-244. https://doi.org/10.1177/014920630202800205

Roberts, R. E. (2020). Qualitative interview questions: Guidance for novice researchers. The Qualitative Report. https://doi.org/10.46743/2160-3715/2020.4640

Rodríguez-Abitia, G., & Bribiesca-Correa, G. (2021). Assessing digital transformation in universities. Future Internet, 13(2), 52. https://doi.org/10.3390/fi13020052 10.3390/fi13020052

Royakkers, L., Timmer, J., Kool, L., & van Est, R. (2018). Societal and ethical issues of digitization. Ethics and Information Technology, 20(2), 127–142. https://doi.org/10.1007/s10676-018-9452-x

Rubel, K., Griffiths, R., & Craven, A. (2014). Technology and a Golfer's Course Preference: Does the increase in emerging technology increase the golfer's playing preference? The Sport Journal.
https://thesportjournal.org/article/technology-and-a-golfers-course-preference-does-the-increase-in-emerging-technology-increase-the-golfers-playing-preference-2/

Schallmo, D., Williams, C.A., & Boardman, L. (2017). Digital Transformation of Business Models — Best Practice, Enablers, and Roadmap. Digital Disruptive Innovation.

Schmidt, S.L. (2020). How Technologies Impact Sports in the Digital Age. In: Schmidt, S.L. (eds) 21st Century Sports. Future of Business and Finance. Springer, Cham. https://doi.org/10.1007/978-3-030-50801-2_1

Schwertner, K. (2017). Digital transformation of business. The Journal of Supercomputing, 15, 388-393. https://doi.org/10.15547/tjs.2017.s.01.065

Sebastian, I. M., Ross, J. W., Beath, C. M., Mocker, M., Moloney, K., & Fonstad, N. O. (2020). How big old companies navigate digital transformation. MIS Quarterly Executive, 16, 6. https://doi.org/10.4324/9780429286797-6

Spitz, J., Wagemans, J., Memmert, D., Williams, A. M., & Helsen, W. F. (2021). Video assistant referees (VAR): The impact of technology on decision making in association football referees. Journal of Sports Sciences, 39(2), 147-153. https://doi.org/10.1080/02640414.2020.1809163

Stark, J. (2020). Digital Transformation of Industry: Continuing Change (Decision Engineering). Springer Cham. https://doi.org/10.1007/978-3-030-41001-8

Stolterman, E., & Fors, A. C. (2004). Information technology and the good life: Relevant theory and informed practice. In The Human-Computer Interaction Handbook (pp. 768-781). https://doi.org/10.1007/1-4020-8095-6_45

Taherdoost, H. (2019). What is the best response scale for survey and questionnaire design: Review of different lengths of rating scale/attitude scale/Likert scale. International Journal of Academic Research in Management, 8(1), 1-10. https://ssrn.com/abstract=3588604

Teichert, R. (2019). Digital transformation maturity: A systematic review of literature. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 67(6), 1673-1687. https://doi.org/10.11118/actaun201967061673

Teixeira, C. P., & Fernandes, C. O. (2020). Novel ecosystems: A review of the concept in non-urban and urban contexts. Landscape Ecology, 35(1), 23–39. https://doi.org/10.1007/s10980-019-00934-4

Tsujimoto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y. (2018). A review of the ecosystem concept — Towards coherent ecosystem design. Technological Forecasting and Social Change, 136, 49-58. https://doi.org/10.1016/j.techfore.2017.06.032

Verina, N., & Titko, J. (2019, May). Digital transformation: Conceptual framework. In Proceedings of the International Scientific Conference "Contemporary Issues in Business, Management and Economics Engineering (pp. 9-10). https://doi.org/10.3846/cibmee.2019.073

Verschuren, P., & Doorewaard, H. (2007). Het ontwerpen van een onderzoek.

Vial, G. (2021). Understanding digital transformation: A review and a research agenda. Journal of Strategic Information Systems, 28(2). https://doi.org/10.1016/j.jsis.2019.01.003

Wade, M. R., & Shan, J. (2020). COVID-19 has accelerated digital transformation, but may have made it harder, not easier. MIS Quarterly Executive, 19, 7. https://doi.org/10.17705/2msqe.00034

Wareham, J., Fox, P. B., & Cano Giner, J. L. (2014). Technology ecosystem governance. Organization Science, 25(4), 1195-1215. https://doi.org/10.1287/orsc.2014.0895

Weiss, M., & Gangadharan, G. R. (2010). Modeling the mashup ecosystem: Structure and growth. R&D Management, 40(1), 40-49. https://doi.org/10.1111/j.1467-9310.2009.00582.x

Wessel, L., Baiyere, A., Ologeanu-Taddeï, R., Cha, J., & Jensen, T. B. (2021). Unpacking the difference between digital transformation and IT-enabled organizational transformation. Journal of the Association for Information Systems, 22(6), 6. https://doi.org/10.17705/1jais.00655

Westerman, G., & Bonnet, D. (2015). Revamping your business through digital transformation. Journal Name, 56, 2-5.

Westerman, G., Bonnet, D., & McAfee, A. (2014). Leading Digital: Turning Technology into Business Transformation. Harvard Business Press.

Wolff, J. (2021). How is technology changing the world, and how should the world change technology? Global Perspectives, 2. https://doi.org/10.1525/gp.2021.27353

Zaoui, F., & Souissi, N. (2020). Roadmap for digital transformation: A literature review. Procedia Computer Science, 175, 621-628. https://doi.org/10.1016/j.procs.2020.07.090

Zaoui, F., & Souissi, N. (2018). Onto-digital: An ontology-based model for digital transformation's knowledge. International Journal of Information Technology and Computer Science. https://doi.org/10.5815/ijitcs.2018.12.01

Zaoui, F., Assoul, S., & Souissi, N. (2019). What are the main dimensions of digital transformation? Case of an industry. International Journal of Recent Technology and Engineering, 8(2), 9962-9970. https://doi.org/10.35940/ijrte.D4418.118419

7.2 Grey literature

ANWB Golf (2024, 18 July). NGF golf registratie ANWB Golf, retrieved from https://www.anwbgolf.nl/lidmaatschap/ega-handicapregistratie

Atwood, A. (2024, February 23). Owls in popular culture. Owl Facts and Information, retrieved from https://owlworlds.com/owls-in-popular-culture/

Capgemini. (n.d.). Understanding Digital Mastery today. In capgemini.com, retrieved from https://www.capgemini.com/wp-content/uploads/2018/07/Digital-Mastery-Report_Digital.pdf

Cybergolf. (n.d.). KNOW YOUR CUSTOMER PLAYBOOK, retrieved from https://cdn.cybergolf.com/images/1867/Golf--know_your_customer_playbook.pdf

Digital Sport. (2014). A Timeline of Technology in Sport, retrieved from https://digitalsport.co/a-timeline-of-sporting-technology

F1 TV. (n.d.). F1 TV, retrieved from https://f1tv.formula1.com/

Government of the Netherlands. (n.d.). Coronavirus Covid-19, retrieved from https://www.government.nl/topics/coronavirus-covid-19

Golf Monthly. (2023). Why Is LIV Golf So Controversial?, retrieved from https://www.golfmonthly.com/features/why-is-liv-golf-so-controversial

Lightspeed. (2023). Golf Industry Trends Report: Where is the Game Headed in 2023?, retrieved from https://www.lightspeedhq.com/blog/golf-industry-trends/

LinkedIn. (n.d.). Jackie Fenn, retrieved from https://www.linkedin.com/in/jackie-fenn-6567183/

LIV Golf. (2022). LIV Golf format, retrieved from https://www.livgolf.com/liv-format

LIV Golf. (2023). LIV Golf honored with two world golf awards in 2023, retrieved from https://www.livgolf.com/news/liv-golf-honored-with-two-world-golf-awards-in-2023

McKeown, N. (2020, February 6). Digital Mastery. The Digital Transformation People, retrieved from https://www.thedigitaltransformationpeople.com/channels/delivery/digital-mastery/

NGF. (2017, October). Blik vooruit. GolfMarkt, 13.

NGF. (2021). De golfmarkt in cijfers NGF, retrieved from https://www.ngf.nl/-/media/pdfs/golfmarkt-statistieken-in-caddie/2021/statistieken-golfmarkt-april-2021.pdf

NGF. (2022). Statistieken Ledenontwikkeling NGF, retrieved from https://www.ngf.nl/-/media/pdfs/ngf/jaarverslagen/2021/statistieken-ledenontwikkeling-peildatum-1-april.pdf

NGF. (2023). Technologische en digitale trends in golf, retrieved from https://www.ngf.nl/caddie/baanmanagement/golfmarkt-reportages/digitale-en-technologische-trends-in-golf

NGF. (n.d.-a). De golfregels, retrieved from https://www.ngf.nl/caddie/golfregels/regels

NGF. (n.d.-b). GOLFGO, retrieved from https://www.ngf.nl/caddie/baanmanagement/golfgo

Origin and meaning of golf terms - Scottish Golf History. (n.d.). Scottish Golf History, retrieved from https://www.scottishgolfhistory.org/origin-of-golf-terms

PGA Tour. (n.d.). PGA TOUR selects TrackMan tracking and tracing solution beginning in 2022, retrieved from https://www.pgatour.com/article/news/latest/2022/02/02/pga-tour-selects-trackman-tracking-tracing-solution-beginning-in-2022

Player 1st. (2019). Customer Experience Management and the Golf Business, retrieved from https://golf.fi/wp-content/uploads/2019/01/Golfkent%C3%A4n-asiakaskokemuksen-johtaminen-P1.pdf

TEMPORAL CHANGES OF ECOSYTEMS | principlesof-ecology. (n.d.). Principlesof-ecology, retrieved from https://emmabriggs.wixsite.com/principlesof-ecology/temporal-changes-of-ecosytems

Topgolf. (n.d.). Experience, retrieved from https://topgolf.com/us/experience/

Toptracer. (n.d.). Our story, retrieved from https://toptracer.com/about/

USA Today. (2023). A complete timeline of LIV Golf, leading up to PGA Tour merger, retrieved from https://golfweek.usatoday.com/lists/liv-golf-history-pga-tour-merger/

USGA. (2023). Revised Golf Ball Testing Conditions to Take Effect in 2028, retrieved from https://www.usga.org/content/usga/home-page/articles/2023/12/revised-golf-ball-testing-conditions-to-take-effect-in-2028.html

USGA. (n.d.). Rules and Clarifications, retrieved from https://www.usga.org/rules/rules-and-clarifications/rules-and-clarifications.html#!ruletype=fr&section=rule&rulenum=1

8 Appendices

Appendix A: Ethics and Privacy Quick Scan

Response Summary:

Section 1. Research projects involving human participants

P1. Does your project involve human participants? This includes for example use of observation, (online) surveys, interviews, tests, focus groups, and workshops where human participants provide information or data to inform the research. If you are only using existing data sets or publicly available data (e.g. from Twitter, Reddit) without directly recruiting participants, please answer no.

Yes

Recruitment

P2. Does your project involve participants younger than 18 years of age?

No

P3. Does your project involve participants with learning or communication difficulties of a severity that may impact their ability to provide informed consent?

No

P4. Is your project likely to involve participants engaging in illegal activities?

No

P5. Does your project involve patients?

No

P6. Does your project involve participants belonging to a vulnerable group, other than those listed above? No

P8. Does your project involve participants with whom you have, or are likely to have, a working or professional relationship: for instance, staff or students of the university, professional colleagues, or clients?

No

Informed consent

PC1. Do you have set procedures that you will use for obtaining informed consent from all participants, including (where appropriate) parental consent for children or consent from legally authorized representatives? (See suggestions for information sheets and consent forms on the website.) Yes

PC2. Will you tell participants that their participation is voluntary?
Yes

PC3. Will you obtain explicit consent for participation?
Yes

PC4. Will you obtain explicit consent for any sensor readings, eye tracking, photos, audio, and/or video recordings?
Yes

PC5. Will you tell participants that they may withdraw from the research at any time and for any reason? Yes

PC6. Will you give potential participants time to consider participation?
Yes

PC7. Will you provide participants with an opportunity to ask questions about the research before consenting to take part (e.g. by providing your contact details)?
Yes

PC8. Does your project involve concealment or deliberate misleading of participants? No

Section 2. Data protection, handling, and storage

The General Data Protection Regulation imposes several obligations for the use of **personal data** (defined as any information relating to an identified or identifiable living person) or including the use of personal data in research.

D1. Are you gathering or using personal data (defined as any information relating to an identified or identifiable living person)?
Yes

High-risk data

DR1. Will you process personal data that would jeopardize the physical health or safety of individuals in the event of a personal data breach?
No

DR2. Will you combine, compare, or match personal data obtained from multiple sources, in a way that exceeds the reasonable expectations of the people whose data it is?

No

DR3. Will you use any personal data of children or vulnerable individuals for marketing, profiling, automated decision-making, or to offer online services to them?
No

DR4. Will you profile individuals on a large scale?
No

DR5. Will you systematically monitor individuals in a publicly accessible area on a large scale (or use the data of such monitoring)?
No

DR6. Will you use special category personal data, criminal offense personal data, or other sensitive personal data on a large scale?
No

DR7. Will you determine an individual's access to a product, service, opportunity, or benefit based on an automated decision or special category personal data?
No

DR8. Will you systematically and extensively monitor or profile individuals, with significant effects on them? No

DR9. Will you use innovative technology to process sensitive personal data?
No

Data minimization

DM1. Will you collect only personal data that is strictly necessary for the research? Yes

DM4. Will you anonymize the data wherever possible?
Yes

DM5. Will you pseudonymize the data if you are not able to anonymize it, replacing personal details with an identifier, and keeping the key separate from the data set?
Yes

Using collaborators or contractors that process personal data securely

DC1. Will any organization external to Utrecht University be involved in processing personal data (e.g. for transcription, data analysis, data storage)?
No

International personal data transfers

DI1. Will any personal data be transferred to another country (including to research collaborators in a joint project)?
No

Fair use of personal data to recruit participants

DF1. Is personal data used to recruit participants?
No

Participants' data rights and privacy information

DP1. Will participants be provided with privacy information? (Recommended is to use as part of the information sheet: For details of our legal basis for using personal data and the rights you have over your data please see the University's privacy information at www.uu.nl/en/organisation/privacy.) Yes

DP2. Will participants be aware of what their data is used for?
Yes

DP3. Can participants request that their personal data be deleted?
Yes

DP4. Can participants request that their personal data be rectified (in case it is incorrect)? Yes

DP5. Can participants request access to their personal data?
Yes

DP6. Can participants request that personal data processing is restricted?
Yes

DP7. Will participants be subjected to automated decision-making based on their personal data with an impact on them beyond the research study to which they consented?
No

DP8. Will participants be aware of how long their data is being kept for, who it is being shared with, and any safeguards that apply in case of international sharing?
Yes

DP9. If data is provided by a third party, are people whose data is in the data set provided with (1) the privacy information and (2) what categories of data you will use?
Yes

Using data that you have not gathered directly from participants

DE1. Will you use any personal data that you have not gathered directly from participants (such as data from an existing data set, data gathered for you by a third party, data scraped from the internet)? Yes

DE2. Will you use an existing dataset in your research?
Yes

DE3. Do you have permission to do so from the owners of the data set?
Yes

DE4. Have the people whose data is in the data set consented to their data being used by other researchers and/or for purposes other than that for which that data set was gathered?
Yes

DE5. Are there any contractual conditions attached to working with or storing the data from DE2? No

DE6. Does your project require access to personal data about participants from other parties (e.g., teachers, employers), databanks, or files?
No

DE9. Does the project involve collecting personal data from websites or social media (e.g., Facebook, Twitter, Reddit)?
No

Secure data storage

DS1. Will any data be stored (temporarily or permanently) anywhere other than on password-protected University authorized computers or servers?
No

DS4. Excluding (1) any international data transfers mentioned above and (2) any sharing of data with collaborators and contractors, will any personal data be stored, collected, or accessed from outside the EU? No

Section 3. Research that may cause harm

Research may cause harm to participants, researchers, the university, or society. This includes when technology has dual-use, and you investigate an innocent use, but your results could be used by others in a harmful way. If you are unsure regarding possible harm to the university or society, please discuss your concerns with the Research Support Office.

H1. Does your project give rise to a realistic risk to the national security of any country? No

H2. Does your project give rise to a realistic risk of aiding human rights abuses in any country? No

H3. Does your project (and its data) give rise to a realistic risk of damaging the University's reputation? (E.g., bad press coverage, public protest.)
No

H4. Does your project (and in particular its data) give rise to an increased risk of attack (cyber- or otherwise) against the University? (E.g., from pressure groups.)
No

H5. Is the data likely to contain material that is indecent, offensive, defamatory, threatening, discriminatory, or extremist?
No

H6. Does your project give rise to a realistic risk of harm to the researchers?
No

H7. Is there a realistic risk of any participant experiencing physical or psychological harm or discomfort? No

H8. Is there a realistic risk of any participant experiencing a detriment to their interests as a result of participation?
No

H9. Is there a realistic risk of other types of negative externalities?
No

Section 4. Conflicts of interest

C1. Is there any potential conflict of interest (e.g. between research funder and researchers or participants and researchers) that may potentially affect the research outcome or the dissemination of research findings?
No

C2. Is there a direct hierarchical relationship between researchers and participants? No

Section 5. Your information.

This last section collects data about you and your project so that we can register that you completed the Ethics and Privacy Quick Scan, sent you (and your supervisor/course coordinator) a summary of what you filled out, and follow up where a fuller ethics review and/or privacy assessment is needed. For details of our legal basis for using personal data and the rights you have over your data please see the University's privacy information. Please see the guidance on the ICS Ethics and Privacy website on what happens on submission.

Z0. Which is your main department?
Information and Computing Science

Z1. Your full name:
Max Thomas van der Weide

Z2. Your email address:
m.t.vanderweide@students.uu.nl

Z3. In what context will you conduct this research?
As a student for my master thesis, supervised by::
N.A. Brand

Z5. Master programme for which you are doing the thesis
Business Informatics

Z6. Email of the course coordinator or supervisor (so that we can inform them that you filled this out and provide them with a summary):
n.a.brand@uu.nl

Z7. Email of the moderator (as provided by the coordinator of your thesis project): g.wagenaar@uu.nl

Z8. Title of the research project/study for which you filled out this Quick Scan:
Transforming the ancient: A paper about the sudden adoption and acceptance of technology among golfers

Z9. Summary of what you intend to investigate and how you will investigate this (200 words max): This paper intends to investigate the following question: How can an entity evaluate the rate and range of digital technology transformation within an ecosystem? The paper focuses on the case of golf as an example of a sport that has undergone a digital transformation due to the COVID-19 pandemic and other factors.
Literature review: The paper will conduct a comprehensive literature review to identify current models and theories related to digital technology transformation, ecosystems, and golf.
Comparative analysis: The paper will compare and contrast the existing models and theories, and identify their commonalities, differences, and gaps. The paper will also propose adaptations or alterations to these models and theories to better suit the specific requirements of assessing digital technology transformation within ecosystems. Experiment: The paper will conduct an experiment in an existing ecosystem, namely the Royal Dutch Golf Federation (NGF), to test and validate the proposed model.

Z10. In case you encountered warnings in the survey, does supervisor already have ethical approval for a research line that fully covers your project?
Not applicable

Scoring

Privacy: 0
Ethics: 0

End of Appendix A: Ethics and Privacy Quick Scan

Appendix B: Golfer questionnaire

Y-axis: Digital golfer capabilities, Golfer focused: The extent of which a golfer has implemented digital technologies within their golf experience:

Fijn dat je wilt meewerken aan dit onderzoek naar digitale transformatie in de golfsport!

Het invullen van de vragenlijst is anoniem en duurt ongeveer 5 tot 10 minuten.

Het onderzoek wordt uitgevoerd door Max van der Weide, MSc-student aan de Universiteit Utrecht.

Praktische informatie & gegevensbescherming

Dit onderzoek wordt uitgevoerd in het kader van de masteropleiding Business Informatics aan de Universiteit Utrecht.

Je persoonlijke gegevens worden niet opgeslagen en je antwoorden worden geanonimiseerd. Aan het einde van het onderzoek wordt een geanonimiseerd resultaat openbaar gemaakt en worden de individuele resultaten vernietigd. De individuele resultaten per golfclub worden gedeeld met de golfclub zelf, maar ze krijgen niet te zien wie het formulier heeft ingevuld.

Je deelname is vrijwillig. Je kan je op elk moment terugtrekken uit het onderzoek.

Er is geen vergoeding of beloning.

Het onderzoek wordt onafhankelijk uitgevoerd.

Als je klachten hebt over privacy, neem dan contact op met de Functionaris Gegevensbescherming van de Universiteit Utrecht via fg@uu.nl. De Functionaris Gegevensbescherming is niet betrokken bij het onderzoek zelf.

Als je een supervisor van het onderzoek wilt spreken, neem dan contact op met de afdeling Information and Computing Sciences op science.secr.cs@uu.nl en vraag naar de supervisor(s) van M.T. van der Weide, MSc Business Informatics.

Als je andere vragen hebt, kan je contact opnemen met de onderzoeker via m.t.vanderweide@students.uu.nl.

Consent

Hierbij verklaar ik de informatiebrief over dit onderzoek te hebben gelezen en akkoord te gaan met deelname aan het onderzoek.

Dit betekent dat ik akkoord ga met:
1) Deelname aan het onderzoek
2) Het verzamelen van mijn antwoorden op de vragen
3) Het delen van mijn geanonimiseerde resultaten in het openbare onderzoek
4) Het delen van mijn geanonimiseerde resultaten met de golfclub waar ik lid van ben

- ☐ Ik ga akkoord.
- ☐ Ik ga niet akkoord.

Questionnaire

Je krijgt zo een paar vragen over de stappen die je zet tijdens je golfervaring op een golfbaan.

Eerst krijg je een vraag over welke stappen je zet.
Daarna krijg je een vraag bij welke van deze stappen je gebruik maakt van digitale technologieën.

Plotting Bij welke golfbaan ben je lid?

0 _____

Plotting Stel je wilt gaan golfen, welke stappen neem je dan voordat je beslist op welke golfbaan je gaat spelen?

- ☐ Ik ga op zoek naar locaties waar ik kan golfen..
- ☐ Ik kijk naar recensies.
- ☐ Ik controleer de baanstatus.
- ☐ Ik bekijk de weersvoorspelling.
- ☐ Ik boek een tee-tijd.
- ☐ (Optioneel) Andere stappen::

_____

Plotting Je gaf bij de vorige vraag aan deze stappen te nemen. Bij welke van je aangegeven stappen maak je gebruik van digitale technologieën?

Automatic: Carry forward choices

- ☐ Ik ga op zoek naar locaties waar ik kan golfen..
- ☐ Ik kijk naar recensies.
- ☐ Ik controleer de baanstatus.
- ☐ Ik bekijk de weersvoorspelling.
- ☐ Ik boek een tee-tijd.
- ☐ (Optioneel) Andere stappen::

_____

Plotting Welke stappen neem jij zodra je op de golfbaan aankomt?

- ☐ Ik check in bij de receptie.
- ☐ Ik maak gebruik van de horeca.
- ☐ Ik huur golfspullen.
- ☐ (Optioneel) Andere stappen:

_____

Plotting Je gaf bij de vorige vraag aan deze stappen te nemen. Bij welke van je aangegeven stappen maak je gebruik van digitale technologieën?

Automatic: Carry forward choices

- ☐ Ik check in bij de receptie.
- ☐ Ik maak gebruik van de horeca.
- ☐ Ik huur golfspullen.
- ☐ (Optioneel) Andere stappen:

_____

Plotting Welke stappen neem jij bij het oefenen op de golfbaan?

- ☐ Ik ga oefenen op de driving range.
- ☐ Ik ga putten oefenen.
- ☐ Ik ga chippen oefenen.
- ☐ (Optioneel) Andere stappen:

_____

Plotting Je gaf bij de vorige vraag aan deze stappen te nemen. Bij welke van je aangegeven stappen maak je gebruik van digitale technologieën?

Automatic: Carry forward choices

- ☐ Ik ga oefenen op de driving range.
- ☐ Ik ga putten oefenen.
- ☐ Ik ga chippen oefenen.
- ☐ (Optioneel) Andere stappen:

_____

Plotting Welke stappen neem jij bij het spelen op de golfbaan?

- ☐ Ik bepaal vanaf welke kleur (tee) ik speel.
- ☐ Ik bekijk de afstand tot de vlag.

- ☐ Ik bekijk de grootte en de vorm van de hole.
- ☐ Ik kijk of er mogelijke obstakels zijn.
- ☐ Ik zoek mijn mikpunt.
- ☐ Ik sla mijn slag.
- ☐ Ik ga op zoek naar verbeterpunten in mijn laatste swing.
- ☐ Ik ga op zoek naar mijn bal.
- ☐ Ik beoordeel de landingsplaats van mijn bal.
- ☐ Ik tel het aantal slagen.
- ☐ Ik kijk de regels na.
- ☐ Ik noteer mijn score.
- ☐ (Optioneel) Andere stappen:

  _____

Plotting Je gaf bij de vorige vraag aan deze stappen te nemen. Bij welke van je aangegeven stappen maak je gebruik van digitale technologieën?

Automatic: Carry forward choices

- ☐ Ik bepaal vanaf welke kleur (tee) ik speel.
- ☐ Ik bekijk de afstand tot de vlag.
- ☐ Ik bekijk de grootte en de vorm van de hole.
- ☐ Ik kijk of er mogelijke obstakels zijn.
- ☐ Ik zoek mijn mikpunt.
- ☐ Ik sla mijn slag.
- ☐ Ik ga op zoek naar verbeterpunten in mijn laatste swing.
- ☐ Ik ga op zoek naar mijn bal.
- ☐ Ik beoordeel de landingsplaats van mijn bal.
- ☐ Ik tel het aantal slagen.
- ☐ Ik kijk de regels na.
- ☐ Ik noteer mijn score.
- ☐ (Optioneel) Andere stappen:

  _____

Plotting Welke stappen neem jij nadat je klaar bent met je golfronde?

- ☐ Ik vul mijn score in.
- ☐ Ik stuur de score op.
- ☐ Ik teken de score(s) van mijn spelpartner(s) af.
- ☐ Ik maak gebruik van de horeca.
- ☐ Ik reserveer een vervolgbezoek.
- ☐ Ik laat een review achter.
- ☐ (Optioneel) Andere stappen:

  _____

Plotting Je gaf bij de vorige vraag aan deze stappen te nemen. Bij welke van je aangegeven stappen maak je gebruik van digitale technologieën?

Automatic: Carry forward choices

- ☐ Ik vul mijn score in.
- ☐ Ik stuur de score op.
- ☐ Ik teken de score(s) van mijn spelpartner(s) af.
- ☐ Ik maak gebruik van de horeca.
- ☐ Ik reserveer een vervolgbezoek.
- ☐ Ik laat een review achter.
- ☐ (Optioneel) Andere stappen:

  _____

Plotting Zijn er nog andere stappen die je in de vraagstelling hebt gemist en waar je digitale technologie bij gebruikt? (Laat de vraag open wanneer alle stappen benoemd zijn)

_____

Geef bij onderstaande stellingen aan in welke mate je het eens of oneens bent met de stelling:

Insights "Ik maak graag gebruik van digitale technologieën bij het golfen"

0 Mee oneens

0 Enigszins mee oneens

0 Neutraal

0 Enigszins mee eens

0 Mee eens

Insights "Ik ben blij dat ik met golfen weinig digitale technologieën hoef te gebruiken"

0 Mee oneens

0 Enigszins mee oneens

0 Neutraal

0 Enigszins mee eens

0 Mee eens

Insights "Ik speel liever op een golfbaan waar digitale technologieën gebruikt worden dan op een golfbaan waar dit niet gebeurt"

0 Mee oneens

0 Enigszins mee oneens

0 Neutraal

0 Enigszins mee eens

0 Mee eens

Insights "Ik word liever lid van een golfclub die digitale technologieën gebruikt dan van een golfclub die dat niet doet"

0 Mee oneens

0 Enigszins mee oneens

0 Neutraal

0 Enigszins mee eens

0 Mee eens

Validation Waren er vragen die moeilijk te begrijpen of te beantwoorden waren?

0 Nee.

0 Ja, deze vragen waren moeilijk te begrijpen en/of te beantwoorden:

_____

End of questionnaire

Bedankt voor je deelname!

Als je vragen hebt, kan je contact opnemen met de onderzoeker via m.t.vanderweide@students.uu.nl.

End of Appendix B: Golfer questionnaire

Appendix C: Course questionnaire

X-axis: Digital course leadership, Course focused: The extent of which a course has implemented new digital innovations and has strategies setup for further implementation.

Fijn dat je wilt meewerken aan dit onderzoek naar digitale transformatie in de golfsport!

Het invullen van de vragenlijst is anoniem en duurt ongeveer 5 minuten.

Het onderzoek wordt uitgevoerd door Max van der Weide, MSc-student aan de Universiteit Utrecht.

Praktische informatie & gegevensbescherming

Dit onderzoek wordt uitgevoerd in het kader van de masteropleiding Business Informatics aan de Universiteit Utrecht.

In dit onderzoek wordt de term "**golfbaan**" gebruikt. Hiermee wordt tevens bedoeld: "**golfclub**", "**club**", "**golfvereniging**", "**vereniging**" of "**baan**", tenzij expliciet anders vermeld.

Je deelname zal uiteindelijk bijdragen aan het kunnen plaatsen van de golfbaan die je vertegenwoordigt op een matrix, door te kijken naar de digitale capaciteiten van de leden en het digitale leiderschap van de golfbaan. Je antwoorden worden gebruikt om het digitale leiderschap van de golfbaan die je vertegenwoordigt aan te kunnen geven.

Je persoonlijke gegevens worden niet opgeslagen en je antwoorden worden geanonimiseerd. Aan het einde van het onderzoek wordt een geanonimiseerd resultaat openbaar gemaakt en worden de individuele resultaten vernietigd. Je hebt de optie om na afloop van het onderzoek de geanonimiseerde resultaten te ontvangen van de golfbaan die je vertegenwoordigt, maar dit is geen verplichte optie.

Je deelname is vrijwillig. Je kan je op elk moment terugtrekken uit het onderzoek.

Er is geen vergoeding of beloning.

Het onderzoek wordt onafhankelijk uitgevoerd.

Als je klachten hebt over privacy, neem dan contact op met de Functionaris Gegevensbescherming van de Universiteit Utrecht via fg@uu.nl. De Functionaris Gegevensbescherming is niet betrokken bij het onderzoek zelf.

Als je een supervisor van het onderzoek wilt spreken, neem dan contact op met de afdeling Information and Computing Sciences op science.secr.cs@uu.nl en vraag naar de supervisor(s) van M.T. van der Weide, MSc Business Informatics.

Als je andere vragen hebt, kan je contact opnemen met de onderzoeker via m.t.vanderweide@students.uu.nl.

Consent

Hierbij verklaar ik de informatiebrief over dit onderzoek te hebben gelezen en akkoord te gaan met deelname aan het onderzoek.

Dit betekent dat ik akkoord ga met:
1) Deelname aan het onderzoek
2) Het verzamelen van mijn antwoorden op de vragen
3) Het delen van mijn geanonimiseerde resultaten in het openbare onderzoek

- ☐ Ik ga akkoord.
- ☐ Ik ga niet akkoord.

Questionnaire

Plotting Wat is de naam van de golfbaan die je vertegenwoordigt?

_____

De volgende vragen gaan over digitale transformatie en digitale initiatieven.
Met digitale transformatie bedoelen we een grote verandering waarbij digitale technologieën worden gebruikt om een organisatie te verbeteren en meer waarde te bieden aan klanten en andere betrokkenen.
Digitale initiatieven zijn projecten of acties die gebruikmaken van digitale technologieën om een organisatie te verbeteren.

Plotting De bestuursleden van onze golfbaan hebben een visie op de digitale toekomst van de golfbaan.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Plotting De bestuursleden van onze golfbaan delen een gezamenlijke visie op digitale transformatie.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens

0 Zeer mee eens

Plotting Het is voor iedereen binnen onze golfbaan, van spelers tot bestuursleden, mogelijk om deel te nemen aan het gesprek over de digitale transformatie van onze golfbaan.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Plotting Onze golfbaan staat open voor cultuurveranderingen om digitale transformatie te bevorderen.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Plotting Onze golfbaan investeert in de nodige digitale vaardigheden.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Plotting Digitale initiatieven worden gecoördineerd door verschillende commissies/afdelingen/functies die daarbij met elkaar samenwerken.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Plotting Op onze golfbaan is heel duidelijk vastgelegd wie verantwoordelijk is voor het realiseren van digitale initiatieven en wie deze initiatieven aanstuurt.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Plotting Het is duidelijk waar digitale initiatieven aan moeten voldoen voordat ze worden geïmplementeerd op onze golfbaan.

0 Zeer mee oneens
0 Mee oneens
0 Enigszins mee oneens
0 Neutraal
0 Enigszins mee eens
0 Mee eens
0 Zeer mee eens

Insights Digitale innovatie is de toekomst van onze organisatie.

0 Mee oneens

0 Neutraal

0 Mee eens

Insights Onze golfbaan is te laat met het introduceren van digitale technologieën.

0 Mee oneens

0 Neutraal

0 Mee eens

Insights Onze golfbaan streeft er bewust naar om zo veel mogelijk analoog te blijven en we zijn er trots op dat we zo min mogelijk veranderen.

0 Mee oneens

0 Neutraal

0 Mee eens

Insights Onze gasten en leden waarderen onze digitale innovaties.

0 Mee oneens

0 Neutraal

0 Mee eens

Insights Onze gasten en leden gebruiken veel digitale innovaties in hun golfspel.

0 Mee oneens

0 Neutraal

0 Mee eens

Insights Onze golfbaan is verder in de digitale transformatie vergeleken met andere golfbanen.

0 Mee oneens

0 Neutraal

0 Mee eens

Validation Waren er vragen die moeilijk te begrijpen of te beantwoorden waren?

0 Nee.

0 Ja, deze vragen waren moeilijk te begrijpen en/of te beantwoorden:

_____

Wil je de uiteindelijke resultaten van het onderzoek ontvangen? Geef dan hier aan op welk mailadres je dit wilt ontvangen:

_____

End of questionnaire

Bedankt voor je deelname!

Als je vragen hebt, kan je contact opnemen met de onderzoeker via m.t.vanderweide@students.uu.nl.

End of Appendix C: Course questionnaire

Appendix D: Most important quotes interview NGF

Full transcript of the interview is available in out-of-document Appendix NGF (Voice 007)

01:01
Q: Is golf laat met het accepteren van technologie?

A: Nou ja, dat is eigenlijk wat ik net vertelde. He? Het digitale wedstrijdformulier, dat is eigenlijk de digitale scorekaart die wij willen met golfen, die was bij andere sporten denk ik 15 jaar, 12 jaar geleden al geaccepteerd. En toen ging de NGF nadenken over: kunnen wij wel met een digitale scorekaart werken? Dus überhaupt het nadenken was dus al tig jaar nadat het geïmplementeerd was voor andere sporten.

03:13
A: Er zijn clubs die van het digitale reserveringssysteem weer teruggaan naar de bal spiraal. Dat hebben we een paar keer gezien. Bizar. [..]. Als gevolg van COVID waren de golfbanen overvol. En dus heel veel golfclubs die zeggen: “Wij hebben zo een reserveringssysteem niet nodig, want we zitten toch wel vol”. Nou was dat een beetje in de nasleep van COVID, alleen nu zien we de afname weer en zien we dat er weer interesse terugkomt.

06:05
A: Er stond letterlijk in de statuten van de NGF en de EGA, de europese golf associatie, de FIFA van golf zegmaar, stond letterlijk in de statuten: Er moet een papier zijn met de scores met de handtekening van de marker, fysieke handtekening, om het een valide score te maken. Dat vonden wij achterhaald met hedendaagse technologie. Alleen de NGF was de eerste in Europa die zei: We gaan met een digitale scorekaart werken. EGA heeft gezegd: Mag niet, gaan we niet doen, maar we willen wel graag weten wat de resultaten zijn. Hier zie je die politieke houding; ze wilden geen goedkeuring geven, maar ze wilde wel zien wat de adoptie zou zijn. Wat je zag is dat golfers het vrij snel gingen accepteren, ik denk dat we al heel snel een base hadden van 30, 40 duizend man die zeggen: Dit is top! [..] Anderen zeiden: nee dit is niet officieel. [..] Er waren heel veel golfers, jonge golfers, middelbare leeftijds golfers, die daar enthousiast over waren. Heel wat oudere golfers zaten nog in dat traditionele stuk van “dat gaan we niet doen”. Nou, die conversie moesten wij op clubniveau er doorheen brengen, en op golferniveau. En dat heeft, om deze adoptie, zeker 6 jaar geduurd.

Q: En je merkte dus echt wel een verschil in adoptie met leeftijd?

A: Ja, zeker.

Q: En waarom merkte je dat verschil?

A: Nou, simpel gezegd: Omdat de ouderen vanuit de traditie van de sport wilden blijven hangen. Dat is een ding. Maar ook technologie vonden ze spannend.

10:51
Q: Stel, je zou één doelgroep in de golfers moeten herkennen. Wat zou jullie doelgroep dan zijn?

A: Dat is een interessante vraag. De doelgroep die we hebben en waar we ons op richten; de doelgroep die we hebben is voornamelijk de blanke man tussen de 30 en de 70. Dat is gewoon de grootste doelgroep. Waar we op focussen op dit moment, en wat de komende 3 jaar onze campagnefocus gaat zijn dat is de doelgroep tussen de 20 en 50, man/vrouw, met wel een lichte extra focus op vrouwen om meer vrouwen op te krijgen omdat die verhouding scheef is.

13:18
Q: Stel, een golfclub stapt nu helemaal af van technologie. Die gaat weer helemaal terug naar het oude systeem. Is dat mogelijk überhaupt?

A: Niet als ze aangesloten willen blijven bij de NGF. Ik zal je uitleggen waarom. Wij hebben leden uitwisseling. En een club kan een lidmaatschap bij de NGF nemen. [..] De golfers zijn niet lid van de NGF. Als de club lid wil worden bij de NGF dan verplichten wij ze om minimaal leden uitwisseling en scorekaarten uit te wisselen met ons.

Q: En stel ze doen dat wel, maar de rest niet, zou je dan verwachten dat ze wel bestaansrecht hebben?

A: Zeker

Q: Maar dat zijn niet veel, of wel?

A: Nee, dat zijn die clubs waar ik het net over had. Die traditionele clubs die eigenlijk meer ledenclubs zijn, die zijn happy dat ze een ledenclub zijn en dat hun leden komen spelen. Dat zijn niet perse de clubs die openstaan of zich openstellen voor greenfeespelers of vernieuwing. Gaan die clubs het in de toekomst moeilijker hebben? Ja, want daar zijn de gemiddelde leeftijden 60+. Dus ergens moeten ze toch die keuze maken om toch die transitie te doen of zeggen: Jongens, het was leuk en gezellig, maar dit gaat het niet meer worden.

21:52
Q: Het handicapregistratie of kaarten invullen, is dat een open API?

A: Nee.

Q: Dat moet een vendor echt aanvragen?

A: Ja

Q: Betalen ze daar ook voor?

A: Nee. [..] Nu mag je je bij ons aansluiten [als softwarevendor] met criteria dat je als hoofddoel van je software ledenadministratie doet en minimaal 1 aangesloten club in Nederland. Vervolgens eisen we ook dat je scorekaart en handicapregistratie kan voeren in dat systeem.
[..] Ik denk dat ik maandelijks 10 aanvragen krijg van partijen die gebruik willen maken van onze APIs.

25:33
Q: Als je kijkt naar andere landen, Amerika heeft een hele andere golf cultuur dan in Nederland

A: Dat is veel meer open.

Q: Hoef je geen handicap te houden?

A: Nee. Je hoeft geen baanpermissie te halen, geen golfregelexamen te doen.

Q: Hoe denk je dat die hele cultuur inspeelt op de hele acceptatie omtrent technologie?

A: Heel simpel: Al die dingen die wij instellen, dat zijn drempels. Zo simpel is het. En ook drempels om de doelgroep die wij erin willen hebben, er in te krijgen. Vanuit ons imago onderzoek is gewoon gebleken dat vrouwen en jeugd die helemaal niet willen. Ze willen trainen, ze willen spelen en ze willen beter worden. [..] That's it. En logisch. En dat is precies zo in Amerika. [..] Het is een heel ander sentiment. En dat sentiment stralen we ook uit op dit moment nog. En is dus een drempel en niet interessant voor de doelgroep die we eigenlijk op die baan willen krijgen.

Q: En zie je intern een beweging richting het verlagen van die drempels?

A: Zeker. Binnen de NGF zijn we heel erg aan het kijken hoe we dat zo glad mogelijk kunnen maken voor toetreders. Door bijvoorbeeld een baanpermissie af te schaffen. Door bijvoorbeeld een regelexamen af te schaffen.

34:49
Q: In het pro niveau van de Amerikaanse golfbond wordt het zo verplicht dat de technologie van golfballen terug wordt gebracht.

A: Ja, dat klopt, dat ze minder ver slaan.

Q: Ja. Het is heel controversieel. Denk je dat die boosheid spreekt tot het karakter dat golf niet houdt van verplichte verandering?

A: Ja. Exact dat. Exact dat. Ja. Daar zit ook nog een lobby achter van de golfbal industrie. Zeg maar, hoe logisch is het met de technologie van vandaag dat jij een zendertje in je golfbal bouwt, dat je altijd je golfbal terugvindt. Hoe logisch is dat? Klinkt vrij simpel. De lobby van de grote golfbal merken [REDACTED BY RESEARCHER], die zijn dat super aan het tegenhouden omdat het een miljoenen business is. [..] Dus dat zit er ook nog achter.

39:31
Q: En we spraken voordat we begonnen, over de de transitie van jullie architectuur, van jullie systemen. Je begon over een text bestand. Daar begonnen jullie mee. Hoe is uiteindelijk die transitie gegaan? Naar het, als het goed is, goeie systeem wat er nu staat?

A: Geleidelijk, we hebben, en de reden dat het geleidelijk is gegaan, is dat en die zestien club software leveranciers hebben die we allemaal moesten omzetten naar het nieuwe systeem. Daarnaast hadden we ook nog clubs die zeiden: ik wil niet om maar op het nieuwe systeem blijven. Dus de gradatie was dat we de clubs moesten overtuigen en die clubs software leveranciers moesten overtuigen. Vervolgens gingen de club softwareleveranciers eerst ook nog met de hakken in het zand van ja, het werk toch laat me met rust en sommige mensen die zeiden van JSON? Nog nooit van gehoord. Dus we hadden te maken met traditionele developers binnen de clubs softwarepakketten die dus niet geschikt waren om op de huidige manier van techniek te koppelen.

41:46
Q: En dan [met die transitie] hebben we het over een paar jaar?

A: 3 jaar. En dat had niks te maken met of wij er al klaar voor waren, want wij waren er al na een halfjaar klaar voor om iedereen technisch over te zetten, het is puur 3 jaar politiek geweest, praten met die clubs, overhalen, leverancier praten met die clubs. Iedereen stond met zijn hakken in het zand.

Q: En was dat het zo lang duurde vooral omdat ze er niet klaar voor waren, of omdat ze het niet wilde?

A: Beide, echt beide. Het merendeel was er niet klaar voor, een aantal waren echt heel stug, tot echt het laatste moment “we willen het niet”, toen hebben we gezegd: “OK, wij gaan het andere systeem uitzetten dus kies maar of je je NGF lidmaatschap wil houden of niet” “Ja dat willen we” “Nou, dan moet je”.

End of Appendix D: Most important quotes interview NGF

Appendix E: Most important quotes interview Duchell

Full transcript of the interview is available in out-of-document Appendix Duchell (Voice 010)

03:08
A: Gamification wordt steeds belangrijker. Daar hebben we heel veel focus op, omdat we zien [..] dat op het moment dat je de jeugd aan wilt spreken en de nieuwe toetreders laagdrempelig wilt bereiken om kennis te laten maken met het mooie spelletje golf, digitaliseren het belangrijkste uitgangspunt moet zijn. En met gamification zie je [..] dat de doelgroep veel breder wordt.

06:59
A: Wij hebben daar [gamification systeem] als Duchell een adviserende rol, omdat we door de markt - gelukkig - als autoriteit worden gezien.

09:26
A: De NGF heeft hun ideeën, maar er is bijvoorbeeld nauwelijks overleg tussen Duchell en NGF, nauwelijks of niet.

10:24
A: Maar dat Nederland dusdanig voorloopt waar het gaat om digitalisering, ten opzichte van België, Frankrijk. Duitsland is helemaal een drama, dat onze positie, bijna voorrechtspositie - want iets wat we hier positief ontvangen wordt is pas over 2, 3, 4 jaar ook in andere Europese landen interessant.

Q: Dat is echt wat jullie merken ook?

A: Ja. Dus de adoptie van digitalisering is in Nederland heel goed.

11:22
A: Ik zie dat, met name in de laatste jaren, de NGF een doorontwikkeling heeft gemaakt naar, van een organisatie die naar binnen gekeerd is heel erg naar buiten gericht is. [..]

Q: Zou je zeggen van de NGF, dat zij vergeleken misschien 10 jaar geleden, wat centraler zijn gaan staan binnen het ecosysteem?

A: Centraler vind ik lastig, in zoverre dat ik denk dat neutraler het goede woord is. Ze zijn in ieder geval, als je dat bedoelt met centraler, wat meer tussen de golfer gaan staan dan daarboven.

14:11
Q: Zijn dat vooral oudere mensen denk je? [over mensen die spelen op banen waar geen digitale technologieën zijn.]

A: Ja, 100%.

35:54
A: De vooringenomenheid vanuit de golfmarkt is nog steeds groot. “Zo deden we het vroeger ook. Dit is wat golf is en dit is wat golf moet blijven”. Super traditioneel.

Q: En dat merk je nog steeds?

A: Dat merk je helaas nog heel veel.

Q: Heb je ooit van een bestuurslid van een golfbaan gemerkt; oh, die wil wel.

[..]

A: Ja, tuurlijk. Het voordeel is dat de hele samenleving digitaliseert.

Q: Wat zijn de grootste verschillen van mensen die daar zitten [bestuur van golfbaan] die niet bezig zijn met digitale strategie en de mensen die wel bezig zijn met digitale strategie?

A: De mensen die daar niet mee bezig zijn, die willen alles bij het oude houden. Die staan ook niet open voor nieuwe toetreders.

Q: Conservatief?

A: Conservatief, ja. Die staan beperkt open [..] voor nieuwe doelgroepen. Dat komt ook voort uit de hoos die we hebben gezien na corona. Het gros van de golfbanen [..], de budgetten zijn hoog, want het is goed gegaan. Ledenstops links en rechts. Nieuwe toetreders. En de gevaarlijke reflex daarvan is arrogantie: “Onze propositie is goed genoeg, want we hebben 1500 leden. Waarom zouden we veranderen?”.

37:28
A: [..] De algemene trend of het gevoel wat vaak heerst in de golfmarkt, zeker van een aantal jaren geleden, is heel erg traditioneel, terughoudend, arrogant. En je voelt nu eindelijk, de afgelopen 2, 3, 4 jaar, dat daar een verandering gaande is. Dat golf leuker wordt, laagdrempeliger wordt door allerlei initiatieven. Een daar moet ik ook de NGF een compliment voor geven, die hebben dat ondanks alle kritiek - want zeuren kan altijd, dat komt vaak vanuit die oude golfer -, maar de marketingcampagnes, de rode broeken acties, dat heeft een positieve spinoff naar hoe er naar golf gekeken wordt.

End of Appendix E: Most important quotes interview Duchell

Appendix F: Most important quotes interview E-Golf4U

Full transcript of the interview is available in out-of-document Appendix E-Golf4U (Voice 006)

02:33
A: De NGF geeft de GSNs uit [Golf Servicenummer]. Die beheert dus het hele handicapsysteem. Vroeger lag dat bij de softwarepakketten, tegenwoordig ligt dat dus bij de NGF.

06:04
Q: Weet je toevallig iets van de transitie naar standaard softwarepakketten? [..] Is dat een beetje rond 2020 gegaan dat golfbanen zijn overgestapt naar echt pakketten afkopen?

A: Nee, je ziet dat E-Golf4u bestaat sinds 2007. [..] Wat je wel ziet is dat de teetijd module vanaf corona wel explosief groeide bij de banen die dat nog niet hadden.Want toen werd het een verplichting. Maar de CRM? Dat was er al vanaf 2000.

08:49
A: Er zijn voors en tegens [van een baan reserveringssysteem]. Een tegen is dat het de spontaniteit weghaalt van golfen en je ziet dat golfers elkaar wat minder ontmoeten. [..] Nu parkeren ze de auto, want ze weten dat ze om twaalf uur een tee tijd hebben. [..] Voor het spelen wordt dan niet gedronken.

Q: En dat zijn dan minder inkomsten van de horeca?

A: Ja. Of dat nadeel super groot is? Mwa. Als je moet wachten, ga je dingen doen. Extra oefenen, of je gaat richting het clubhuis koffie drinken of je naar naar de shop en je gaat in de shop kijken.

11:40
Q: Het invullen van scorekaarten, dat gaat tegenwoordig allemaal via de app. En dat verschilt ook nog per land. Want Nederland is daar heel vooruitstrevend in, maar bijvoorbeeld [..] Oostenrijk: “Moet je die scorekaarten zelf invullen via de telefoon?”. Hadden ze nog nooit van gehoord. [..] Wij lopen bijvoorbeeld tien jaar achter op de Amerikanen. Of vijf tot tien jaar. Niet alles is daar goed, maar bijvoorbeeld Oostenrijk loopt weer achter op ons. De technologie die wij hebben, die is bij hen totaal nog niet binnengekomen.

End of Appendix F: Most important quotes interview E-Golf4U

Appendix G: Most important quotes interview PGA Holland

Full transcript of the interview is available in out-of-document Appendix PGA Holland (Voice 008)

38:13

A: Er zijn heel veel golfclubs allemaal bezig om hun klassieke driving ranges uit de jaren 80 om te bouwen naar digitale driving ranges.

[..]

A: Uiteindelijk gaan alle golfclubs in Nederland hun driving ranges vervangen door iets digitaal.

End of Appendix G: Most important quotes interview PGA Holland

Appendix H: Most important quotes interview NGA

Full transcript of the interview is available in out-of-document Appendix NGA (Voice 011)

08:08

A: In de toekomst [..] gaan wij naar de driving range met technologie, voor het afslaan.

13:01

Q: Hoe werkt de samenwerking met jullie en de NGF?

A: Goed. Er zijn wat verschuivingen nu bij de NGF, ik hoop dat we daar gebruik van kunnen maken door het nog beter te maken, nog hechter. In principe gaat het goed. Ja, we hebben veel contact met elkaar. NGF, NVG en NGA, we noemen onszelf ook de golfalliantie.

End of Appendix H: Most important quotes interview NGA

Appendix I: All sources found using backward snowballing (Initial starting sources listed in Table 5) for the first secondary research question

(Kraus et al., 2021)
(Gölzer & Fritzsche, 2017)
(Berman, 2012).
(Majchrzak, Markus, & Wareham, 2016)
(Hinings, Gegenhuber, & Greenwood, 2018)
(Chen, Jaw, & Wu, 2016)
(Stolterman, & Fors, 2004).
(Burton-Jones et al., 2020)
(Parviainen et al., 2022)
(Gong & Ribiere, 2021)
(Alekseevna, Yakovlevna, & Vasilievich, 2017)
(Vial, 2021)
(Matt, Hess, & Benlian, 2015)
(Verina & Titko, 2019)
No references found that aligned with the aforementioned criteria
(Morakanyane et al., 2017)
No references found that aligned with the aforementioned criteria
(Magesa & Jonathan, 2020)
No references found that aligned with the aforementioned criteria
(Bellantuono et al., 2021)
(Dikhanbayeva et al., 2020)
(Butt, 2020)

(Rautenbach et al., 2019)
(Issa et al., 2018)
(Gollhardt et al., 2020)
(Westerman et al., 2014)
No references found that aligned with the aforementioned criteria
(Furjan et al., 2018)
No references found that aligned with the aforementioned criteria
(Pihir et al., 2018)
No references found that aligned with the aforementioned criteria
(Rodríguez-Abitia & Bribiesca-Correa, 2021)
(Wessel et al., 2021)
(Wade & Shan, 2020)
(Kääriäinen et al., 2020)
(Marks & Al-Ali, 2022)
(Mahlow & Hediger, 2019)
(Limani et al. 2019)
(Schwertner, 2017)
(Vial, 2021)
(Helfat & Raubitschek, 2018)
(Earley, 2014)
(Sebastian et al., 2020)
(Gray & Rumpe, 2017)
(Morakanyane et al., 2017)
(Magesa & Jonathan, 2020)
(Hess, Matt, Benlian, & Wiesböck, 2020)

(Zaoui & Souissi, 2020)
(Zaoui, Assoul, & Souissi, 2019)
(Matt, Hess, & Benlian, 2015)
(Zaoui & Souissi, 2018)
(Paulus-Rohmer et al., 2016)
(Heilig et al., 2017)
No references found that aligned with the aforementioned criteria

End of Appendix I: All sources found using backward snowballing (Initial starting sources listed in Table 5) for the first secondary research question

Appendix J: Extracted themes and their characteristics per reference for the first secondary research question

Source	**Themes**
(Kraus et al., 2021)	Digital transformation rationale: *The increasing digitalization of economies has highlighted the importance of digital transformation and how it can help businesses stay competitive in the market. [..]* *Companies unable to rapidly develop and implement DT strategies and new digital business models are unlikely to keep pace and compete with the new digital reality.* *[..]* *Organizations that introduce DT as a part of their strategy consequently obtain the respective benefits thereof and are able to advantageously remain in the market.* Resistant to change: *Moreover, successful companies often do not accept change, and employees are resistant to digital change, which leads to difficulties in implementing DT in the organization.* Digital rationale: *Digital technologies not only impact the transformation of products, business processes, or sales, but entire business models as well.* Digitisation: *The mere experimentation with and implementation of digital technologies is insufficient for transformation because digital strategies additionally have to be formulated.* *[..]* *The effective use of investments in IT and technology is necessary to generate business benefits and performance* Digital customer: *[..] consumer-centric industries, obtaining strategic value through center-edge DT is made possible by the digitally activated customer. The shift from the center (e.g., the enterprise with its supply chain) to the edge (e.g., the customers with digital connection) of the enterprise requires managing IT deployment and organizational transformation.* [model/framework] Digital transformation framework: *In their conceptual framework, Hess et al. (2016) develop the digital transformation framework (DTF) that identifies four key dimensions for a company-wide DT strategy*

	formulation: the use of technologies, changes in value creation, structural changes, and how to finance DT. Opportunity seekers: *Westerman and Bonnet [..] assume that companies of all sizes are able to question their business models, seek new digital opportunities, and transform the way they do business.*
(Gölzer & Fritzsche, 2017)	Digital transformation in ecosystems: *The digital transformation of industry does not progress with the same speed in all fields of application.* Industry 4.0: *In order to highlight the revolutionary potential of the digital transformation of industry, it has become popular to address it by the term 'Industry 4.0'*
(Berman, 2012)	Planning for success: *In our analysis of leading businesses, we have found that companies with a cohesive plan for integrating the digital and physical components of operations can successfully transform their business models.*
(Majchrzak, Markus, & Wareham, 2016)	-
(Hinings, Gegenhuber, & Greenwood, 2018)	Digital capabilities: *[..] is about the concerted orchestration of new products, new processes, new services, new platforms, or even new business models in a given context*
(Chen, Jaw, & Wu, 2016)	Resource-based perspective: *Using a resource-based perspective, portal delivery functionalities, considered as non-physical IT resources, are analysed using the dimensions of portal usefulness, portal interface, and service-oriented portal functions on [..] users' perceived outcomes of organisational performance.*
(Stolterman, & Fors, 2004)	-
(Burton-Jones et al., 2020)	-
(Parviainen et al., 2022)	Digitisation: *"the action or process of digitizing; the conversion of analogue data (esp. in later use images, video, and text) into digital form."* Digital transformation: *digital transformation, refers to "the changes associated with the application of digital technology in all aspects of human society" [..] digital transformation is defined as changes in ways of working,*

	roles, and business offering caused by adoption of digital technologies in an organization, or in the operation environment of the organization. Changes at levels: *Process level: adopting new digital tools streamlining processes by reducing manual steps;Organization level: offering new services and discarding obsolete practices and offering existing services in new ways;Business domain level: changing roles and value chains in ecosystems;Society level: changing society structures (e.g., type of work, means of influencing decision making).* **MODEL** Model as a snapshot: *The first step is to analyze the potential impact of digitalization for the company and decide on the position that the company wants or needs to take in the change. The second step is to review the current state of the company with respect to the desired position and the impact of digitalization, as well as to identify the gap between the current situation and the wanted future. The third step defines the approach that needs to be taken to close the gap from the organization's current state to the desired position and defines the concrete actions needed to reach the desired position.* *The fourth step is about implementing and validating the actions and returning to previous steps if needed.* *[..]* *First, the impacted areas, or the issues related to the goal, are identified are analyzed. In case the goal is related to internal efficiency, the related processes, tools and resources are identified (these more detailed elements of the areas are called as issues). If the goal is related to external opportunities, customers, competitors, and external resources and processes are identified. If the goal is related to disruptive change, it is likely that all of the company is impacted.* *[..]* *After the impacted areas are identified, their situation in respect to the goal is analyzed. The questions to be answered vary based on the goal. If the goal is internal efficiency, the questions relate to the currently used practices* *[..]* *In case the goal is related to external opportunities, questions are related to the business case*

	[..] *In case the goal is related to disruptive change, the following questions are related to all the company's areas* *[..]* *As a result, a detailed description of the current state with respect to the digitalization goal is described.*
(Gong & Ribiere, 2021)	Digital transformation: *A fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity* and redefine its value proposition for its stakeholders.* Entity within digital transformation: *(*An entity could be: an organization, a business network, an industry, or society.)*
(Alekseevna, Yakovlevna, & Vasilievich, 2017)	Digital transformation: *The zero stage: [..] elementary improvements of an initial state: some objects become electronic and some functions, processes are automated. The first stage: [..] Automatization of the interrelated processes chain happens at this stage. The second stage: [..] At this stage the system that is interacting with the client can receive integrated data about him from different sources. The fourth stage: [..] creation of more and more informed and flexible infrastructure capable to adapt more and more precisely to requirements of the end user.*
(Vial, 2021)	Digital transformation: *In recent years, digital transformation (DT) has emerged as an important phenomenon in strategic IS research (Bharadwaj et al., 2013; Piccinini et al., 2015a) as well as for practitioners (Fitzgerald et al., 2014; Westerman et al., 2011).* *[..]* *At a high level, DT encompasses the profound changes taking place in society and industries through the use of digital technologies (Agarwal et al., 2010; Majchrzak et al., 2016). At the organizational level, it has been argued that firms must find ways to innovate with these technologies by devising "strategies that embrace the implications of digital transformation and drive better operational performance" (Hess et al., 2016:123).* *[..]* *a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*

	Digital rationale: *Digital technologies have a profound impact on the behavior [..] of consumers who have ubiquitous [..] access to information and communication capabilities (e.g., using social media on a mobile device).* Digital transformation rationale: *organizations must devise ways to remain competitive as digital technologies provide "both game changing opportunities for– and existential threats to– companies"* Organisation and Information strategies: *[..] digital technologies call for researchers to study the fusion between organizational strategy and IS strategy [..] rather than their alignment.* Digitisation: *Digital technologies alone provide little value to an organization [..] It is their use within a specific context that enables a firmto uncover new ways to create value* Digital capabilities: *Organizations use digital technologies to transition from or augment the sales of physical products with the sales of services as an integral part of their value proposition to satisfy the needs of customers by offering innovative solutions as well as to gather data on their interactions with products and services [..] organizations use digital technologies to implement changes to their distribution and sales channels [..] Digital technologies can help firms rapidly adapt to changes in environmental conditions* Leadership: *In the context of DT, organizational leaders must work to ensure that their organizations develop a digital mindset while being capable of responding to the disruptions associated with the use of digital technologies*
(Matt, Hess, & Benlian, 2015)	[model/framework] Dimensions of digital transformation strategies: *Independent of the industry or firm, digital transformation strategies have certain elements in common: [..] ["]use of technologies["] addresses a company's attitude towards new technologies as well as its ability to exploit these technologies. [..] ["]changes in value creation["..] These concern the impact of digital transformation strategies on firms' value chains, i.e. how far the new digital activities deviate from the classical– often still analog– core business. ["]Structural changes["] refer to variations in a firm's organizational setup, especially concerning the placement of the new digital activities within the corporate structures. [..] ["] financial aspects["..] These include a firm's urgency to act owing to a diminishing core business and its ability to finance a*

	digital transformation endeavor; financial aspects are both a driver and a bounding force for the transformation. [..] The four transformational dimensions and their dependencies can be integrated into one joint Digital Transformation Framework (DTF). [..] If all of these four dimensions are taken into account as part of the framework, this will support firms in the assessment of their current abilities and the formulation of a digital transformation strategy.
(Verina & Titko, 2019)	Digital rationale: *digitalization is an integral part of the overwhelming development of society, economics and business* Digital transformation: *The digital transformation of a company requires a fundamental organizational change [..] "a digital transformation requires instilling a culture that supports the change while enabling the company's overarching strategy"* *[..]* *[Business digital transformation is ...] "the application of technology to build new business models, processes, software and systems that result in more profitable revenue, greater competitive advantage, and higher efficiency" [..] "Digital transformation is the investment in people and technology to drive a business that is prepared to grow, adapt, scale, and change into the foreseeable future"* Customer inclusion in digital transformation: *[..]"digitization and digitalization are essentially about technology, but the digital transformation is not. Digital transformation is about the customer".*
(Morakanyane et al., 2017)	-
(Magesa & Jonathan, 2020)	Digital rationale: *Currently, we are noticing how digital technologies have been widely integrated in different sectors and within every dimension of human life.* Digital transformation rationale: *These transformations result in fundamental changes to how services are delivered, businesses are operated and how values are delivered to customers.* Digital transformation: *A good number of factors are driving organisations to adopt digital transformation. [..] Pressure from customers, employees, competitors is also a factor speeding up adoption of digital transformation by organizations.* *[..]*

	ability of an organizations to adapt and capitalize on digital technologies to change business models, improve existing work routines, explore new revenue streams, and ensure sustainable value creation
(Bellantuono et al., 2021)	Customer inclusion in digital transformation: *Finally, we also suggest adopting a participatory and human-centric approach in managing a complex I4.0 transition. This means that the actors involved and affected by the change must be an active part in the definition and implementation of the digital transformation initiative.*
(Dikhanbayeva et al., 2020)	[model/framework] Maturity model: *Maturity Models are the means of measurement and matching a concrete set of capabilities required for the companies to reach the desired state.* *[..] Acatech Industrie 4.0 Maturity Index* *[..] Digital Readiness Assessment Maturity Model (DREAMY)* *[..] IMPULS—Industrie 4.0 Readiness* *[..] The Connected Enterprise Model* *[..] Industry 4.0 Maturity Model [Gökalp]* *[..] Industry 4.0 Maturity Model [Schumacher]* *[..] Maturity and Readiness Model for Industry 4.0 Strategy* *[..] Reference Architecture Model Industrie 4.0 (RAMI4.0)* *[..] System Integration Maturity Model Industry 4.0 (SIMMI 4.0)* *[..] Three-Stage Maturity Model* *[..] Digital Operations Self-Assessment (PwC)* *[..] Maturity Model for Industrial Internet* *[..] Singapore Smart Industry Readiness Index—SIRI* *[..] Digitalization Maturity Model for the Manufacturing Industry* *[..] Maturity Model for Data Driven Manufacturing (M2DDM)* *[..] WMG Model*
(Butt, 2020)	-
(Rautenbach et al., 2019)	-
(Issa et al., 2018)	Digital assessment: *To assess the digital maturity of the company, we propose interviews with the task force members within their field of expertise based on already*

	defined questionnaire
(Gollhardt et al., 2020)	Maturity model rationale: *Maturity models aim to assess a company's positioning and* *as-is situation, define and systematize improvement initiatives, and navigate through the evolutionary process* Academic rationale of digital transformation: *While industry and practitioners are paying close attention to this issue, from an academic point of view, digital transformation suffers from underdevelopment of measurement models of digital transformation* Objective point of view: *A digital transformation maturity model brings a systematized view on digital transformation* Digital transformation: *Therefore digital transformation is much more than just the use of trending digital technologies as it affects all possible sides of companies' and human beings' existence* *[..]* *Digital transformation creates multiple challenges for companies and industries: higher market volatility, new disruptive competitors, increased customers expectations, innovative* *touch-points to reach clients or harder competition due to globalization* Maturity model rationale: *academia is increasingly devoting importance to the concept of maturity models.* Maturity model: *A maturity model consists of a sequence of maturity levels for a class of objects. It represents an anticipated, desired, or typical evolution path of these objects shaped as discrete stages. Typically, these objects are organizations or processes* (THIS IS CITED BY THIS SOURCE). *[..]* *Maturity models can serve three different functionalities: assessment of the as-is and here-and-now situation (i.e., descriptive), identification of desired maturity stages and provision of guidance on how to achieve it (i.e., prescriptive), and* *internal (within) or external (across) industry benchmarking* *(i.e., comparative)* Model as a snapshot: *Since a model is always an abstract copy of reality, it becomes outdated if reality changes. In other words, if the context for which a maturity model has been designed evolves over time, the entirety of maturity with respect to the dimensions and levels of this context*

	cannot be represented by the model anymore. Digital transformation in ecosystems: *The ecosystem refers to the collaboration within and outside the company.* Customer inclusion in digital transformation: *The seventh dimension in our model is customer. [1],* *[36], and [8] mentioned the customer-centricity approach as well as the customer journey experience and customer satisfaction as an influential aspect of a digitally maturing company. Additionally, [1] emphasized the value of omnichannel communication with customers. [36] and [4] agreed* *on the importance of the utilization of customer data and selfhelp tools.* *[..]* *the customer perspective and the customer* *centricity approach are recurring aspects regarding digital transformation* *[..]* *The criteria of the initial dimension customer were added to the resulting ecosystem dimension.*
(Westerman et al., 2014)	-
(Furjan et al., 2018)	New model rationale: *The increasing digitization of business processes by new ICT requires developing new business models for organizations to remain competitive on global markets.* Customer inclusion in digital transformation: *Schallmo et al. (Schallmo et al., 2017) defines digital transformation as follows: "The DT framework includes the networking of actors such as businesses and customers across all value-added chain segments, and the application of new technologies.*
(Pihir et al., 2018)	Digital transformation rationale: *The main goal of DT is to change organizations by implementing contemporary technologies and introduce new business processes in order to create new or improve existing products and services and deliver them to the global market faster, cheaper and in new innovative ways.* [model/framework] Maturity assessment: *Current state and position of an organization can be determined through various digital maturity accessing methods, models and frameworks [..]* *[23] N. Evans, "Assessing your organization's digital transformation maturity," cio.com, Aug. 4, 2017. [..] [24]*

	Forrester. "The Digital Maturity Model 5.0.," Forrester, 2018. [..] [25] Government of South Australia, "Digital Maturity Assessment Tool – Governance and leadership," Government of South Australia, 2015.
(Rodríguez-Abitia & Bribiesca-Correa, 2021)	Digital rationale: *As we move deeper into the Fourth Industrial Revolution, emerging and disruptive technologies like the Internet of things (IoT), three-dimensional printing, big data and analytics, machine learning and other forms of artificial intelligence, and cyber-physical systems increase their impact on the creation of streamlined, flexible processes and innovative business models.* [model/framework] Zachman: *This model attempted to provide an integrated framework of IT planning and development, where data, processes, and business functions were taken into consideration in a synergic way and from different organizational levels or perspectives.* Digital transformation: *The notion of digital transformation has gained momentum in the last decade.* *[..]* *Perhaps one of the most balanced definitions describes it as an evolutionary process that takes advantage of digital capabilities and technology to enable business models, operational processes, and consumer experiences that generate value.* *[..]* *Digital transformation can also be viewed from the perspective of the relations among changes in structure, strategy, and technology to help respond to the needs imposed by a digital environment [..], stressing the need to balance between the old and new elements of the organization.* Innovation strategies: *Digital transformation strategies are also innovation strategies that focus on product and process transformation, as well as other organizational issues, thanks to the use of new technology.* Digital transformation in ecosystems: *Digital transformation may have particular industry-specific nuances as well, based on aspects like hardware intensity [..]. It is reasonable to believe that industry and size-specific differences may yield to implementation problems when not considered in the initiative.*
(Wessel et al., 2021)	Academic rationale of digital transformation: *Interest in digital transformation (DT) is spreading*

	across academia and practice at a breathtaking pace. This is evidenced by the increasing number of information systems (IS) publications devoted to this topic Digital transformation: *DT is characterized by the emergence of a new organizational identity*
(Wade & Shan, 2020)	-
(Kääriäinen et al., 2020)	-
(Marks & Al-Ali, 2022)	Digital transformation rationale: *There are several reasons why organizations undergo digital transformation; however, the main reasons are related to the issues of competitive advantage and survival.* *[..]* *Through the process of digital transformation, organizations use multiple new digital technologies, with the intent to achieve superior performance and sustained competitive advantage. In such way, they transform different dimensions of business, such as the business model, the customer experience and operations, and simultaneously impacting people and networks* Maturity assessment: *Does the organization have the right vision and strategy for digital, and the leadership, communications and focus required to support this vision?* *Does the organization have the right talent, skills and knowledge to support its vision, products, and services?* *Does the organization have the right processes, controls and digital technologies to support the operations of the organization?* *Does the organization have the right technologies and infrastructure as well as the ability to develop, manage and deliver?* *Does the organization have the right approach to understanding and communicating with its customers to succeed in a digital environment?* Digital transformation in ecosystems: *The literature shows that digital transformation is usually faced with a number of challenges. More often than not, those challenges are not listed in any specific order based on criticality, and they are not attached to a specific industry* Customer inclusion in digital transformation:

	The seventh challenge facing higher education institutions in UAE was the potential use by customers Digital transformation: *Digital transformation is a process that can hardly be* *historically compared to any other process, as it does not exclude the development levels of different countries.*
(Mahlow & Hediger, 2019)	-
(Limani et al. 2019)	Digital transformation: *Digital transformation represents deep transformation of business activities and processes, and the organization of processes, competences and models to fully exploit the differences and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and priority manner at present and at future shifts [..] The development of new competencies revolves around the capacity to be more resourceful, people-oriented, innovative, customer-oriented, efficient, well-organized and capable of promoting and utilizing the opportunities to change the positioning of services revenue-oriented businesses. Digital transformation efforts and strategies are often more urgent and present in markets with a high degree of commodification [..]* *Digital transformation is one of the biggest catalysts of business evolution.* *[..]* *Digital transformation of an organization represents an objective process capable at responding to changing organizations environments* Digital transformation rationale: *There are several reasons that enterprises may undergo digital transformation, but so far, the main reasons are related to the issues of competitive advantage and survival. [..]* *Restoring new investments in technology, business models and processes to more effectively compete in a continual digital economy shift*
(Schwertner, 2017)	-
(Helfat & Raubitschek, 2018)	-
(Earley, 2014)	Digital transformation rationale: *Companies that anticipate the changing needs of the rapidly changing market place and successfully implement new technology put themselves in a good position to gain the edge over their competitors.*
(Sebastian et al., 2020)	-

(Gray & Rumpe, 2017)	-
(Morakanyane et al., 2017)	Digital transformation: *Westerman et.al. (2014b) alludes that digital transformation takes places in three key areas of the firm: customer experience, operational processes and business models, suggesting that the effects of digital transformation in business organizations are felt in these three key areas.* *[..]* *an evolutionary process that leverages digital capabilities and technologies to enable business models, operational processes and customer experiences to create value* WESTERMAN Leading digital Customer inclusion in digital transformation: *While Westerman et.al. (2014b) allege that these three key areas are what business leaders focus the enterprise's transformation efforts towards, from an "orchestrating the organization" lens, it is established that not all key elements that ensure a perfect organizational orchestration have been included. For instance, Bouee (2015) argue that employees should not be left out in the digital transformation journey. Other researchers, including Matt et.al. (2015), Bharadwaj et.al. (2013), etc. demonstrate how digital transformation impacts organizational structure, while Piccinini (2015a), Loebbeck & Picot (2015), etc. allude that digital transformation impacts relationships. In determining the transformed areas, we however argue that as the benefits of digital transformation are to be felt by both the organization and the customers, it is important to ensure that the transformed areas considered for the general description of digital transformation should be inclusive of both organization and customer. We therefore propose that Westerman et.al. (2014b)'s three key transformed areas are more general and inclusive of both the organization and customer.* Organisation-focussed and customer-focused: *Digital transformation impacts are the effects that business organizations experience as a result of the transformation process. [..] we categorize these impacts into customer-focused and organization-focussed categories, customer focused are the effects that impact customers and organizationfocussed impact the organization itself. We further argue that these impacts can have a positive or negative effect on both the customer and the organization. Different studies have used different verbs to describe actions that digital transformation has on organizations,*

	however we believe the ultimate impact that organizations want to leverage on digital transformation is value creation – to both the organization and customers. Digital capabilities: *technology skills possessed or required by employees, customers and other stakeholders in different areas that can enable the organization to thrive in a digital environment* Digital transformation rationale: *Organization wide effects and benefits realized as a result of the digital transformation effort, realized by both the organization and the customer*
(Hess, Matt, Benlian, & Wiesböck, 2020)	-
(Zaoui & Souissi, 2020)	Digital transformation: *Digital transformation is a worldwide topical issue, of major importance for all companies in all sectors, as it changes customer relationships, internal processes, and value creation.*
(Zaoui, Assoul, & Souissi, 2019)	-
(Zaoui & Souissi, 2018)	-
(Paulus-Rohmer et al., 2016)	Digital transformation: *The digital transformation of people's everyday life is progressing; almost everybody uses connected devices, shares information and builds a network according to the existing preferences or needs.* Digital transformation in ecosystems: *Ecosystems can also overlap each other, since one company can be part of more than one ecosystem. Also competitors, customers, regulatory authorities and other stakeholder who implicitly influence the processes are a part of an ecosystem [..] This means that an organization should think not according to its value chain anymore but in ecosystems and the position the company occupies in an ecosystem.*
(Heilig et al., 2017)	Digital transformation rationale: *Digital transformation is of utmost importance in the business world with major impacts on any of its sectors.*

End of Appendix J: Extracted themes and their characteristics per reference for the first secondary research question

Appendix K: Extracted themes and their characteristics for the first secondary research question

Theme	Characteristics	Ranking by frequency
Digital transformation	Characterised as a fundamental change process (Verina & Titko, 2019, Vial, 2021) associated with the application of digital technology in all aspects of human society, caused by the digital adoption of entities and strategy concerning resources and capabilities (Parviainen et al., 2022, Gong & Ribiere, 2021, Vial, 2021). Digital transformation aims to improve an entity and redefines value propositions. It can also be characterised by the emergence of a new organisational identity (Wessel et al., 2021) which is hard to explain using historic evidence (Marks & Al-Ali, 2022). Digital transformation is a worldwide issue, concerning all organisations in every sector (Zaoui & Souissi, 2020). It has a profound impact on customer relationships, internal processes and value creation as every person is affected by it (Paulus-Rohmer, Schatton & Bauernhansl, 2016, Gollhardt et al., 2020). Digital transformation can be driven by a multitude of factors, as is the speed at which adoption of digital transformation takes place (Magesa & Jonathan, 2020). Digital Leadership for Digital Transformation.). The ability of an entity to adapt to digital technologies is essential to its value creation (Magesa & Jonathan, 2020). Digital Leadership for Digital Transformation.). Digital transformation takes place in three key areas of a firm: customer experience, operational processes and business models (Morakanyane et al., 2017), where it can be described as an evolutionary process that leverages digital capabilities and technologies to enable business models, operational processes and customer experiences to create value. Digital transformation is characterised in stages, going from elementary improvements of an initial state, automatisation of the interrelated processes chain, integrated data delivery and finally flexible infrastructure creation (Alekseevna, Yakovlevna, & Vasilievich, 2017). Digital transformation is one of the biggest catalysts of business evolution (Limani et al. 2019) and represents an objective evolutionary process capable of responding to changing organisations	14

	environments by taking advantage of digital capabilities and technology to enable business models, operational processes, and consumer experiences that generate value (Limani et al. 2019, Rodríguez-Abitia & Bribiesca-Correa, 2021).	
Digital transformation rationale	The increasing digitisation of economies (Kraus et al., 2021) and digital transformation is of utmost importance as it affects every sector (Heilig et al., 2017), resulting in fundamental changes to how businesses operate and value is created (Magesa & Jonathan, 2020). Digital Leadership for Digital Transformation.). Businesses undergo digital transformation for various reasons, leading issues of which are related to business survival (Marks & Al-Ali, 2022), employing new technologies that transform different dimensions simultaneously creating new or improved services that are delivered better (Pihir et al., 2018). Organisations unable to undergo digital transformation are unlikely to keep up with competition and miss out on benefits to remain in the market (Kraus et al., 2021, Limani et al. 2019). Organisations that are able to anticipate the change put themselves in a good position to gain the edge over competitors (Earley, 2014). Organisations must find ways, like restoring new investments in technology, business models and processes (Limani et al. 2019), to remain competitive as digital technologies provide positive and negative effects to them (Vial, 2021). Survival and competitive advantages are the leading reasons for an organisation to undergo digital transformation (Limani et al. 2019). Organisation wide effects and benefits realised as a result of the digital transformation effort, are felt by both the organisation and the customer (Morakanyane et al., 2017).	9
Customer inclusion in digital transformation	Whilst digitisation and digitalisation are essentially about technology, digital transformation is characterised as being about the customer (Verina & Titko, 2019). A participatory and human-centric approach in managing a complex I4.0 transition can be used, meaning that actors involved and affected by change must be an active part in the digital transformation (Bellantuono et al., 2021). A possible challenge for organisations is the potential use by customers (Marks & Al-Ali, 2022). The customer journey and satisfaction are crucial factors in digital maturity (Gollhardt et al., 2020). Omni channel communication is an important part of digital transformation, and customer	6

	perspective and customer-centric approach are consistently emphasised in discussions about digital transformation (Gollhardt et al., 2020). Schallmo et al. (2017) mentions that digital transformation includes the networking of actors such as businesses and customers across all value-added chain segments and the application of new technologies (Furjan et al., 2018). Morakanyane et al. (2017) argue that Westerman et al. (2014) have not included all key elements that ensure a perfect organisational orchestration. They use other sources that argue employees should not be left out of the digital transformation journey, and that digital transformation impacts the entire organisational structure whilst impacting relationships too. Morakanyane et al. (2017) further state that digital transformation is felt by both the organisation as the customer, and therefore proposes extending Westerman's three key transformed areas to be more open to both the organisation and the customer.	
Digital transformation in ecosystems	The nuances of digital transformation vary by industry. (Rodríguez-Abitia & Bribiesca-Correa, 2021). Ignoring industry and size-specific differences can lead to implementation problems during the initiative. (Rodríguez-Abitia & Bribiesca-Correa, 2021). The pace of digital transformation varies across different fields of application within industry (Gölzer & Fritzsche, 2017). Digital transformation is usually faced with a number of challenges which are often not listed in any specific order based on criticality, and are not attached to a specific industry (Marks & Al-Ali, 2022). An ecosystem refers to the collaboration within and outside the company (Gollhardt et al., 2020). Ecosystems can also overlap each other, since one company can be part of more than one ecosystem (Paulus-Rohmer et al., 2016). Competitors, customers, regulatory authorities and other stakeholders who implicitly influence the processes are a part of an ecosystem (Paulus-Rohmer et al., 2016). An organisation should not focus merely on its value chain, but for the entire ecosystem and in which position the organisation wants to occupy that ecosystem (Paulus-Rohmer et al., 2016).	5
Digital rationale	Digital technologies have been widely integrated in different sectors and within every dimension of human life (Magesa & Jonathan, 2020). Digital technologies have an impact on the behaviour of consumers (Vial, 2021). Digital	5

	technologies impact the transformation of products, business processes and sales (Kraus et al., 2021). To a greater extent, they affect entire business models too (Kraus et al., 2021). Digitalisation is an important part of the development of society, economics and business (Verina & Titko, 2019). Moving into Industry 4.0, new technologies increase the effect they have on business models (Rodríguez-Abitia & Bribiesca-Correa, 2021).	
Digitisation	Digitisation is the process of digitising something, which in turn means the conversion of analogue to a digital form (Parviainen et al., 2022). Digital technologies alone provide little value to an organisation and transformation (Kraus et al., 2021, Vial, 2021). It is the use of digital technologies within a specific context and the effective use of investments that enables an organisation to create value (Kraus et al., 2021, Vial, 2021).	3
Digital capabilities	An organisation's capacity to leverage digital technologies across its operations, products, services and business models (Hinings, Gegenhuber, & Greenwood, 2018). These capabilities enable organisations to enhance their value propositions by transitioning from physical product sales to services, meeting customer needs through innovative solutions and adapting distribution and sales channels to changing market conditions (Vial, 2021). Digital capabilities are about the technological skills of employees, customers and other stakeholders, crucial for thriving in a digital environment (Morakanyane et al., 2017).	3
Maturity model	A maturity model represents an anticipated, desired or typical evolution path of organisations or processes shaped as discrete stages (Gollhardt et al., 2020). Maturity models are used to assess the as-is and here-and-now situation, to identify the desired maturity stages and provide guidance on how to achieve it and internal and external industry benchmarking (Gollhardt et al., 2020). Maturity models are in essence the means of measurement and matching a concrete set of capabilities required for the companies to reach the desired state (Dikhanbayeva et al., 2020). There are many maturity models available (Dikhanbayeva et al., 2020).	2
Model as a snapshot	A model is an abstract copy of reality (Gollhardt et al., 2020). When something changes, the model or	2

	implementation of the model can become outdated. If the environment or situation for which a maturity model has been designed evolves over time, the model may no longer accurately represent the full maturity across all dimensions and levels of that environment or situation. (Gollhardt et al., 2020). A description of the current state of digitalisation can be created using a number of steps that analyse the current situation (Parviainen et al., 2022).	
Academic rationale of digital transformation	Digital transformation suffers from underdevelopment of measurement models of digital transformation from an academic point of view, whilst industry and practitioners are paying close attention to the issue (Gollhardt et al., 2020) and interest in digital transformation is spreading (Wessel et al., 2021).	2
Maturity model rationale	Maturity models aim to assess a company‘s positioning and as-is situation, define and systematise improvement initiatives and navigate through the evolutionary process (Gollhardt et al., 2020). Academia is starting to notice the importance of maturity models (Gollhardt et al., 2020).	2
Maturity assessment	An organisation's current status and position can be assessed using a variety of methods, models and frameworks designed to gauge digital maturity (Pihir et al., 2018). A digital assessment can be done through a series of questions concerning an organisation and its strategy and current state (Marks & Al-Ali, 2022).	2
Leadership	Leaders must work to ensure that their organisation develops a digital mindset whilst being able to respond to digital technologies in digital transformation (Vial, 2021).	1
Digital assessment	To assess the digital maturity of the company, interviews with a task force of members within their field of expertise based on already a predefined questionnaire can be conducted (Issa et al., 2018).	1
Organisation-focussed and customer-focused	Customer focused digital transformation impacts are the effects that impact customers (Morakanyane et al., 2017). Organisation focused digital transformation impacts are the effects that impact organisations (Morakanyane et al., 2017).	1
Entity within digital	An entity could be an organisation, a business network, an industry or a society (Gong & Ribiere, 2021).	1

transformation		
New model rationale	The increase of digitisation of business processes requires developing new business models for organisations to remain competitive on global markets (Furjan et al., 2018).	1
Innovation strategies	Digital transformation strategies are innovation strategies that focus on product and process transformation, as well as other organisational issues, thanks to the use of new technology (Rodríguez-Abitia & Bribiesca-Correa, 2021).	1
Zachman	This model attempts to provide an integrated framework of IT planning and development, where data, processes and business functions are taken into consideration in a synergic way and from different organisational levels or perspectives (Rodríguez-Abitia & Bribiesca-Correa, 2021).	1
Objective point of view	A digital transformation maturity model brings a systematised view on digital transformation (Gollhardt et al., 2020).	1
Dimensions of digital transformation strategies	Digital Transformation Framework (DTF) integrates elements such as the use of technologies, changes in value creation, structural adjustments and financial considerations to support firms in assessing their capabilities and formulating digital transformation strategies (Matt, Hess, & Benlian, 2015).	1
Organisation and Information strategies	Digital technologies need researchers to study the fusion between organisational strategy and information system strategy, not merely the alignment between the two (Vial, 2021).	1
Changes at levels	Process level: adopting new digital tools streamlining processes by reducing manual steps Organisation level: offering new services and discarding obsolete practices and offering existing services in new ways Business domain level: changing roles and value chains in ecosystems Society level: changing society structures (Parviainen et al., 2022).	1
Resource-based perspective	A resource-based perspective can be used to analyse resources using dimensions of a functionality. A service-oriented functionality can be analysed using the	1

	user's perceived outcome of organisational performance (Chen, Jaw, & Wu, 2016).	
Planning for success	Companies with a cohesive plan for integrating the digital and physical components of operations can successfully transform their business models (Berman, 2012).	1
Industry 4.0	Digital transformation of industry is addressed in academic culture by the popular term “Industry 4.0” (Gölzer & Fritzsche, 2017).	1
Resistant to change	Successful companies often do not accept change. Employees within are resistant to digital change, which leads to difficulties in implementing digital transformation in the organisation (Kraus et al., 2021).	1
Opportunity seekers	Westerman and Bonnet (2015) assume that companies of all sizes are able to question their business models, seek new digital opportunities and transform the way they do business (Kraus et al., 2021).	1
Digital transformation framework	The digital transformation framework, developed by Hess et al (2016), identifies four key dimensions for a company-wide digital transformation strategy, with the four keys being “the use of technologies”, “changes in value creation”, “structural changes” and “how to finance digital transformation” (Kraus et al., 2021).	1
Digital customer	A digitally activated customer makes garnering a strategic value through digital transformation possible in customer-centric industries (Kraus et al., 2021).	1

End of Appendix K: Extracted themes and their characteristics for the first secondary research question

Appendix L: All sources found using backward snowballing (Initial starting sources listed in Table 7) for the second secondary research question

(Tsujimoto et al., 2018)
(Kapoor & Lee, 2010)
(Wareham, Fox, & Cano Giner, 2014)
(Battistella et al., 2012)
(Weiss & Gangadharan, 2010)
(Bogers et al., 2019)
No references found that aligned with the aforementioned criteria
(Granstrand & Holgersson, 2020)
(Borgh, Cloodt, & Romme, 2012)
(Jacobides et al., 2018)
(Malik et al., 2011)
(Bouquet, Stoermer, Niederee, & Maña, 2008)
(Hassell, Aleman-Meza, & Arpinar, 2006)
(Adner, 2017)
(Adner & Kapoor, 2010)
(den Hartigh & Asseldonk, 2004)
(Lu et al., 2014)
(Fu et al., 2024)
(Paulus-Rohmer et al., 2016)
(Biondi, 2005)
No references found that aligned with the aforementioned criteria

(Andrews et al., 2009)
(Richardson et al., 2002)
(Carter & Cullen, 1984)
(Hage & Aiken, 1967)
(Negandhi & Reimann, 1973)
(Arnold, 1999)
No references found that aligned with the aforementioned criteria
(Chang & Harrington, 2000)
(Govindarajan, 1986)

End of Appendix L: All sources found using backward snowballing (Initial starting sources listed in Table 7) for the second secondary research question

Appendix M: Extracted themes and their characteristics for the second secondary research question

Source	**Themes**
(Tsujimoto et al., 2018)	Concept of entities in an ecosystem: *Each actor in the ecosystem has different attributes, decision-making principles, and purposes.* Ecosystem as an entity: *The business ecosystem is a complex living entity, but it is also an artifact at the same time.* Ecosystem as a network: *To provide a product/service system, an historically self-organized or managerially designed multilayer social network consists of actors that have different attributes, decision principles, and beliefs.* Ecosystem boundaries: *[..] the boundary of the ecosystem can be set by the consumers' perception of the product/service system.*
(Kapoor & Lee, 2010)	Ecosystem as a network: *Firms are embedded in a business ecosystem of interdependent activities carried out by their customers, complementors, and suppliers.* Importance of interdependencies: *These interdependencies underlie firms' ability to appropriate returns from investments in new technologies.*
(Wareham, Fox, & Cano Giner, 2014)	-
(Battistella et al., 2012)	Entity impact on ecosystem: *[..] understanding how business decisions or actions taken by one entity impact all of the interrelated entities become a key challenge.* Ecosystem as a network / Ecosystem types: *Like biological ecosystems, business ecosystems are formed by large, loosely connected networks of entities.*
(Weiss & Gangadharan, 2010)	-
(Bogers et al., 2019)	Ecosystem as a network: *[..] definition of an ecosystem as an interdependent network of self-interested actors jointly creating value.* Success of an ecosystem: *[..] success criterion for an*

	ecosystem: to jointly create value in a way that no single actor would be able to do.
(Granstrand & Holgersson, 2020)	Ecosystem types: *An innovation ecosystem is the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors.*
(Borgh, Cloodt, & Romme, 2012)	Ecosystem types: *[..] knowledge-based ecosystem as a heterogeneous set of knowledge-intensive companies and other participants that depend on each other for their effectiveness and efficiency, and as such need to be located in close proximity.* Ecosystem as a network: *[..] managing an ecosystem implies creating and sustaining an environment where collaboration between (initially) loosely interconnected companies can evolve and take place.*
(Jacobides et al., 2018)	Ecosystem as a network: *[..] ecosystems are groups of firms that must deal with either unique or supermodular complementarities that are non-generic, requiring the creation of a specific structure of relationships and alignment to create value.* Concept of entities in an ecosystem: A*n ecosystem is a set of actors with varying degrees of multi-lateral, non-generic complementarities that are not fully hierarchically controlled.* Ecosystem value: *[Ecosystems] provide a structure within which complementarities (of all types) in production and/or consumption can be contained and coordinated without the need for vertical integration. [..] ecosystems allow for some degree of coordination without requiring hierarchical governance, precisely because of the ability to use some standards or base requirements that allow complementors to make their own decisions (in terms of design, prices, etc.), while still allowing for a complex interdependent product or service to be produced.* Ecosystem governance: *Overall, powerful firms (especially hubs, or hub contenders) craft rules and shape the process of ecosystem development to tie in complements and make complementors abide to them.*
(Malik et al., 2011)	-
(Bouquet, Stoermer, Niederee, & Maña, 2008)	-

(Hassell, Aleman-Meza, & Arpinar, 2006)	-
(Adner, 2017)	Ecosystem rationale: *The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize.*
(Adner & Kapoor, 2010)	Ecosystem value: *[..] linking the dynamics of value creation and their implications for value capture to the structure of interdependence in a firm's ecosystem.* Importance of interdependencies: *The success of an individual innovation, however, is often dependent on the success of other innovations in the firm's external environment.*
(den Hartigh & Asseldonk, 2004)	Ecosystem innovator types: *First, firms can choose to follow a 'shaper' strategy by sponsoring their own proprietary* *technology that will generate high returns when it becomes dominant in the market [..] firms can choose to follow an 'adapter' strategy [..] Such a strategy involves joining the dominant technology by acquiring a license for developing products based on this technology [..] firms can choose to wait committing themselves to either technology network in the market. This [..] means doing all that is necessary to create or keep open opportunities [..]*
(Lu et al., 2014)	Ecosystem innovator types:*[..] the stakeholder's contribution will gradually decline, but will still stay within the business ecosystem, and do all the necessary business if needed [..], and thus we name this the "opportunist".*
(Fu et al., 2024)	Ecosystem innovator types: *Facilitators [..] create value through the orchestration of resources in the dimensions of people, goods, and scenes.*
(Paulus-Rohmer et al., 2016)	Ecosystem overlap: *Ecosystems can also overlap each other, since one company can be part of more than one ecosystem.* Entity personality: *Also competitors, customers, regulatory authorities and other stakeholder who implicitly influence the processes are a part of an ecosystem*

(Biondi, 2005)	-
(Andrews et al., 2009)	Hierarchy of authority: *Hierarchy of authority refers to the extent to which the power to make decisions is exercised at the upper levels of the organizational hierarchy [..]* Participation in decision making: *[..] participation in decision making pertains to the degree of staff involvement in the determination of organizational policy.* Centralised characteristics: *A centralized organization will typically have a high degree of hierarchical authority and low levels of participation in decisions about policies and resources [..].* Decentralised characteristics: *[..] a decentralized organization will be characterized by low hierarchical authority and highly participative decision making.*
(Richardson et al., 2002)	Ecosystem as a network: *[..] organizations are inescapably bound up with the conditions of their environments [..]* Centralisation in a network: *Centralization between a center and its larger parent organization can serve to buffer the center from environmental turbulence, enabling the center to achieve dependability and avoid excessive internal disorder. At the same time, the turbulent environment in which centers operate necessitates some degree of decentralization in order to achieve flexibility and adaptability.* Centralisation rationale: *[..] providing a center with little general autonomy in terms of making decisions about how it is run.*
(Carter & Cullen, 1984)	-
(Hage & Aiken, 1967)	Degree of centralisation rationale: *[..] how power is distributed among social positions [..]* Degree of centralisation measurement: *[1:] [..] participation in decision making, represents how much the occupants of various positions participate in decisions about the allocation of resources and the determination of organization policies.* *[2:] [hierarchy of authority] refers to decisions involving the work associated with each social position.*
(Negandhi & Reimann, 1973)	-

(Arnold, 1999)	-
(Chang & Harrington, 2000)	Centralisation rationale: *In the case of a retail chain, this question takes the form of how much discretion corporate headquarters should give to store managers.*
(Govindarajan, 1986)	Centralisation rationale: *[..] decentralization is viewed as the locus of decision-making authority that is delegated to the general manager of the strategic business unit (SBU) by his/her corporate superiors.*

End of Appendix M: Extracted themes and their characteristics for the second secondary research question

Appendix N: Extracted themes and their characteristics ranked by frequency for the second secondary research question

Theme	Characteristics	Ranking by frequency
Ecosystem		
Ecosystem as a network	Characterised as a multilayer network, an ecosystem consists of actors with varying attributes and decision principles. Like biological ecosystems, business ecosystems are expansive networks of loosely connected entities which are intertwined in interdependent activities alongside other entities like customers, complementors and suppliers. This interdependent network of self-interested entities collaboratively generates value. Organisations are intrinsically linked to their environmental conditions within these ecosystems.	7
Ecosystem types	Next to the definition of an ecosystem, each ecosystem can also have a type that concerns the objective goal of the ecosystem. A standard ecosystem, defined as a cluster of loosely connected networks of entities, can also be defined as a business ecosystem. An innovation ecosystem is an evolving set of actors that are important for the innovative performance of an actor or a population of actors. Knowledge-based ecosystems are a heterogeneous set of knowledge-intensive companies and other participants that depend on each other for their effectiveness and efficiency.	3
Ecosystem innovator types	An entity within an ecosystem can be classified in a type. The first type is a shaper, being an entity that sponsors their own proprietary technology. The second type is an adapter, developing their own product or service based on a shaper's technology. The third type is an opportunist, who waits for new opportunities. The fourth type is the facilitator, who links actors in the ecosystem, orchestrating resources across people, goods and scenes.	3
Concept of entities in an ecosystem	An ecosystem is a set of actors with different attributes, decision-making principles and purposes, and varying	2

	degrees of multilateral, non-generic complementarities that are not fully hierarchically controlled.	
Importance of interdependencies	Interdependencies highlight the network that shapes the landscape for innovation, emphasising the need for organisations to leverage interconnections. The success of individual entity innovation, which frequently depends on the accomplishments of other innovations within the entity's external ecosystem, and the capacity of entities to realise profits from investments in new technology are both indications of the significance of interdependencies.	2
Ecosystem value	Ecosystems link the dynamics of value creation and their implications for value capture to the structure of interdependence in an ecosystem, allowing for some degree of coordination without requiring hierarchical governance whilst still allowing for the production of a complex interdependent product or service.	2
Ecosystem as an entity	The business ecosystem is a complex living entity and an artefact at the same time.	1
Ecosystem overlap	Ecosystems can overlap.	1
Entity personality	Competitors, customers, regulatory authorities and other stakeholders who implicitly influence the processes are a part of an ecosystem	1
Ecosystem boundaries	The boundary of the ecosystem can be set by the consumers' perception of the product/service system.	1
Entity impact on ecosystem	Business decisions or actions taken by one entity impact all of the interrelated entities.	1
Success of an ecosystem	Jointly create value in a way that no single actor would be able to do.	1
Ecosystem governance	Overall, powerful firms (especially hubs, or hub contenders) craft rules and shape the process of ecosystem development to tie in complements and make complementors abide by them.	1
Ecosystem rationale	The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialise.	1
Entity		

-	-	-
Centralisation		
Centralisation rationale	Centralisation speaks to the extent that decision making is done in a central hub. Decentralisation speaks to the extent at which this decision making capability is delegated.	3
Hierarchy of authority	Hierarchy of authority refers to the extent to which the power to make decisions is exercised at the upper levels of the organisational hierarchy.	1
Participation in decision making	Participation in decision making pertains to the degree of staff involvement in the determination of organisational policy.	1
Centralised characteristics	A centralised organisation will typically have a high degree of hierarchical authority and low levels of participation in decisions about policies and resources	1
Decentralised characteristics	A decentralised organisation will be characterised by low hierarchical authority and highly participative decision making.	1
Centralisation in a network	Centralisation between a centre and its larger parent organisation can serve to buffer the centre from environmental turbulence, enabling the centre to achieve dependability and avoid excessive internal disorder. At the same time, the turbulent environment in which centres operate necessitates some degree of decentralisation in order to achieve flexibility and adaptability.	1
Degree of centralisation rationale	How power is distributed among social positions.	1
Degree of centralisation measurement	1: Participation in decision making, represents how much the occupants of various positions participate in decisions about the allocation of resources and the determination of organisation policies. 2: Hierarchy of authority refers to decisions involving the work associated with each social position.	1

End of Appendix N: Extracted themes and their characteristics ranked by frequency for the second secondary research question

Appendix O: Statements for “How well is your organization building leadership capabilities?” (Westerman et al., 2014)

Senior executives have a transformative vision of the digital future of our company.
Senior executives and middle managers share a common vision of digital transformation.
There are possibilities for everyone in the company to take part in the conversation around digital transformation.
The company is promoting the necessary culture changes for digital transformation.
The company is investing in the necessary digital skills.
Digital initiatives are coordinated across silos such as functions or regions.
Roles and responsibilities for governing digital initiatives are clearly defined.
Digital initiatives are assessed through a common set of key performance indicators.
IT and business leaders work together as partners.
The IT unit’s performance meets the needs of the company

End of Appendix O: Statements for “How well is your organization building leadership capabilities?” (Westerman et al., 2014)

Appendix P: Statements for "How well is your organization building digital capabilities?" (Westerman et al., 2014)

We are using digital technologies (such as analytics, social media, mobile, and embedded devices) to understand our customers better.
We use digital channels (such as online, social media, and mobile) to market our products and services.
We sell our products and services through digital channels.
We use digital channels to provide customer service.
Technology is allowing us to link customer-facing and operational processes in new ways.
Our core processes are automated.
We have an integrated view of key operational and customer information.
We use analytics to make better operational decisions.
We use digital technologies to increase the performance or added-value of our existing products and services.
We have launched new business models based on digital technologies.

End of Appendix P: Statements for "How well is your organization building digital capabilities?" (Westerman et al., 2014)