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Smart Agility Test And Training With Integration Analysis (SATRIA): A Prisma-Based Systematic Literature Review Toward Generation Digital Agility Assessment Framework

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ABSTRACT

Background: The development of the concept of agility in sports science has shifted from just the ability to change of direction speed to a multidimensional ability involving physical, cognitive, and response to stimulus aspects. Although various agility instruments have been developed, most still focus on measuring test completion time and have not yet integrated digital performance analysis or adaptive training recommendations. Objective: This study aims to analyze the development of agility concepts, measurement instruments, training methods, and the use of digital technology in sports performance evaluation, as well as propose a conceptual framework for Smart Agility Test and Training with Integration Analysis (SATRIA). Methods: The study used Systematic Literature Review (SLR) based on the PRISMA 2020 guidelines. Literature searches were conducted on Scopus, Web of Science, PubMed, and Google Scholar databases using a combination of keywords related to agility test, reactive agility, agility training and sport technology. Articles were selected based on inclusion and exclusion criteria, then analyzed using thematic synthesis. Results: A synthesis of the literature shows that agility research is evolving towards an approach that integrates the ability to change direction, reaction time, visual perception, decision-making, and movement quality. Based on these findings, this study proposes a conceptual framework for SATRIA that integrates five main dimensions, namely physical agility, reactive agility, cognitive agility, movement quality, and digital performance analytics, in one digital technology-based evaluation and training system. Conclusion: SATRIA offers a new generation of agility evaluation framework that connects testing, performance analysis and data visualization. This conceptual model has the potential to be the basis for the development of more comprehensive digital agility instruments and improve the quality of superior human resources.

Keywords: *reactive agility; smart agility; satria; test and training; systematic literature review, integration analysis*

1. INTRODUCTION

Agility is one of the biomotor components that plays an important role in supporting the performance of athletes in various sports, especially game sports, racquet sports, martial arts, and sports that require a rapid change in the direction of movement. This ability allows athletes to efficiently accelerate, decelerate, change of direction, and adjust body position in dynamic match situations. Therefore, agility is one of the main indicators in the process of talent identification, evaluation of physical condition, preparation of training programs, and monitoring the development of athlete performance (Sheppard & Young, 2006). Over the decades, the concept of agility has undergone significant development. At first, agility was seen as the ability to change the direction of movement quickly without losing balance. This approach gave birth to various conventional measurement instruments such as the Illinois Agility Test, T-Test, 505 Agility Test, and Pro-Agility Shuttle Test which are oriented towards change of direction speed. Although such instruments have been widely used in various sports, their measurements still focus on the mechanical aspects of movement and do not fully represent the actual demands of the match (Young et al., 2015).

The development of sports coaching science then showed that agility is not just a physical ability, but a multidimensional ability that involves the interaction between neuromuscular, biomechanical, perceptual, and cognitive factors. Sheppard and Young (2006) define agility as the ability to perform rapid whole-body movements accompanied by a change in speed or direction in response to a stimulus. The definition emphasizes that agility must include the ability to recognize stimuli, process information, make decisions, and execute movements quickly and precisely. Thus, agility can no longer be separated from components such as reaction time, anticipation, visual perception, and decision making (Young et al., 2015). This paradigm shift gave birth to the concept of reactive agility, which is the ability to change direction in response to unexpected external stimuli. Unlike planned agility tests that use a fixed and previously known movement trajectory, reactive agility requires athletes to integrate perceptual skills, information processing, and motor responses in a very short period of time. Various studies show that reactive agility has higher ecological validity because it better reflects the actual match situation, when athletes have to react to the opponent's movement, ball position, and changes in game conditions (Paul et al., 2016; Young & Farrow, 2013).

In addition to the development of the concept of agility, the advancement of digital technology has also brought major changes in the field of sports performance evaluation. The use of wearable sensors, inertial measurement units (IMUs), motion capture systems, artificial intelligence-based cameras, Internet of Things (IoT), and cloud computing allows the measurement process to be carried out automatically, objectively, and in real-time. The technology not only produces data on test completion time, but is also able to record biomechanical parameters such as acceleration speed, angle of change of direction, movement efficiency, step patterns, and performance variability during training and matches (Peake et al., 2018; Camomilla et al., 2018).

The digitization of sports evaluation also encourages the development of the concept of performance analytics, which is the process of collecting, processing, visualizing, and interpreting athlete performance data to support evidence-based decision-making. Through a digital analysis system, coaches no longer only obtain final scores in the form of travel time, but also obtain more comprehensive information on movement quality, performance consistency, ability improvement tendencies, and training recommendations that can be personalized according to the characteristics of each athlete (Baca & Kornfeind, 2012; Rein & Memmert, 2016). On the other hand, the development of agility training methods has also undergone a transformation. Modern exercise programs are no longer limited to direction-change exercises using cone drills or ladder drills, but have evolved into perception–action coupling-based exercises that combine visual stimuli, auditory stimuli, decision-making, and motor responses. Scientific evidence suggests that exercises that integrate physical and cognitive components result in greater increases in reactive agility than conventional direction-change exercises (Zhao et al., 2025).

Although the development of research on agility continues to increase, systematic studies show that there are still a number of limitations in the instruments currently available. Most of the measuring tools only produce scores in the form of test completion time so they are not able to describe the quality of athletes' responses to stimuli, movement accuracy, and biomechanical characteristics that occur during the test implementation. In addition, the integration between the testing (testing), training, monitoring, and performance analysis processes in one digital system is still relatively limited (Moreno et al., 2022).

Departing from this gap, a new approach is needed that is able to integrate the entire process of evaluation and development of agility capabilities in one comprehensive system. One of the concepts that can be developed is Smart Agility Test and Training with Integration Analysis (SATRIA), which is a digital technology-based agility measurement and training system that combines agility testing, cognitive stimulus, automatic recording, performance analysis, and adaptive training recommendations in one integrated platform. Although various studies have discussed agility, reactive agility, and the application of technology in sports, until now there have not been many studies that specifically integrate these three aspects into a complete conceptual framework. Therefore, a systematic literature synthesis is needed to identify the development of agility concepts, measurement instruments, training methods, and the use of digital technology as the basis for the development of the Smart Agility Test and Training with Integration Analysis (SATRIA) model.

Based on this background, this study aims to conduct a Systematic Literature Review (SLR) using the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) to analyze the development of research on agility test, reactive agility, agility training, and sports performance analysis technology. The results of the synthesis are expected to provide a scientific basis for the development of the SATRIA model as an innovation in the digital technology-based agility evaluation and training system as well as identify research directions that need to be developed in the future (Page et al., 2021).

2. LITERATURE REVIEW

2.1. Smart Agility Concept

Smart Agility is a new paradigm in the measurement and development of agility that integrates physical abilities, cognitive functions, and digital technology in one comprehensive evaluation and training system. In contrast to the conventional concept of agility which only focuses on the ability to change of direction speed, Smart Agility views agility as the result of a multidimensional interaction between neuromuscular abilities, visual perception, decision-making, reaction speed, and technology-based performance analysis (Sheppard & Young, 2006; Paul et al., 2016).

This concept is evolving as the complexity of modern sports increases. In match situations, athletes are not only required to move quickly, but also to be able to recognize environmental stimuli, process information quickly, choose the right response, and execute movements efficiently. Therefore, modern agility measurements must be able to evaluate physical, cognitive, and movement quality aspects simultaneously (Young & Farrow, 2013).

In this context, Smart Agility integrates three main components, namely stimulus-based testing (smart testing), adaptive training (smart training), and digital performance analysis (integration analysis). These three components form a system that is able to provide comprehensive information about athletes' performance while generating data-driven training recommendations.

2.2. The Theoretical Foundations of Smart Agility

The development of Smart Agility is based on several key theories in sports science, motion science, sports psychology, and sports technology. The main foundation of Smart Agility comes from the theory of agility put forward by Sheppard and Young (2006). They define agility as: "A rapid whole-body movement with change of velocity or direction in response to a stimulus." This definition shows that agility consists of two major components, namely Change of Direction Speed (CODS) this is mechanical ability to change the direction of the body and Influenced by muscle strength, power, and movement techniques. Perceptual–Decision Making the ability to recognize stimuli, processing information, Choose the best response. This model is the basis that agility is not just a physical ability, but a combination of motor and cognitive abilities. The Ecological Dynamics theory explains that athlete performance is the result of interaction between individuals, tasks, and the environment (Davids et al., 2013). In this theory, athletes continuously adapt to changes in game situations through the process of perception–action coupling. The concept is the basis of Smart Agility because testing no longer uses a fully pre-known trajectory, but utilizes visual or digital stimuli so that athletes must adjust movements based on the information received in real-time. According to the Perception–Action Coupling theory, perception and movement are two processes that cannot be separated (Fajen et al., 2009). The visual information that athletes receive directly influences the motor decisions made. In Smart Agility, this theory is realized through the use of random stimuli that require participants recognize the target, choosing the direction of movement, change direction, back to the starting position, repeat the process continuously. Thus, cognitive ability and motor ability are measured simultaneously.

2.2.4. Information Processing Theory

Information processing theory explains that human performance consists of several stages is stimulus received, information is perceived, decision made and motor response is executed. (After Schmidt & Lee, 2019). In Smart Agility, all of these stages occur sequentially so that the measurement results not only reflect the speed of movement but also the efficiency of cognitive processes.

2.2.5. Motor Learning Theory

According to the theory of movement learning (Schmidt & Lee, 2019), the improvement of motor skills occurs through a repetitive training process accompanied by feedback. Smart Agility utilizes Automatic feedback, performance scores, development dashboard and exercise recommendations. This approach allows the training process to be more adaptive and individualized according to the needs of the athlete.

2.2.6. Sports Technology Theory

Advances in sports technology allow performance measurement to be carried out objectively through the use of digital sensors, wearable devices, AI-based cameras, and cloud computing (Camomilla et al., 2018). In Smart Agility, technology is used to automatic timekeeping, reaction time analysis, evaluation of movement accuracy, data storage, dashboard visualization and monitoring athlete development. Evaluation no longer relies on the coach's subjective observation.

2.3. Conceptualization of Smart Agility

Based on the synthesis of the theory, Smart Agility can be defined as "A digital technology-based agility measurement and training system that integrates the ability to change direction, response to stimuli, cognitive function, movement quality, and performance analysis automatically to support the comprehensive evaluation and development of athletes' abilities."

Table 1. concept consists of five main dimensions:

Dimensions	Indicator
Physical Agility	Speed, acceleration, deceleration, change of direction
Reactive Agility	Reaction time, response to stimulus
Cognitive Agility	Visual perception, attention, decision-making
Movement Quality	Movement accuracy, track efficiency, coordination
Digital Performance Analysis	Auto-logging, dashboards, performance analytics

This model shows that Smart Agility is a process that starts from the physical capacity of the athlete, continues with response to stimuli, information processing, movement execution, digital recording, performance analysis, and finally generating feedback for adaptive training.

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2.4. Novelty Smart Agility
Compared to conventional agility instruments, Smart Agility offers several scientific novelties:

1. Multidimensional Integration: combines physical, cognitive, and digital components in a single evaluation system.
2. Adaptive Stimulus: uses random visual or digital stimuli to better represent the situation of the match.
3. Integrated Performance Analysis: generates information on reaction time, motion accuracy, trajectory efficiency, and performance consistency, not just test completion time.
4. Data-Driven Dashboard: provides visualization of results and practice recommendations that support evidence-based decision-making.
5. Continuous Cycle Approach: connecting testing, analysis, adaptive exercises, and re-evaluation in a single digital ecosystem.

3. RESEARCH METHODOLOGY

3.1 Research Design

This study uses the Systematic Literature Review (SLR) method with reference to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The SLR approach was chosen because it allows the process of identification, selection, evaluation, and synthesis of literature to be carried out in a systematic, transparent, and replicable manner so as to produce more comprehensive scientific evidence than conventional narrative reviews (Page et al., 2021). The purpose of this systematic review is to identify, analyze, and synthesize research results regarding the development of agility test, reactive agility, agility training, sport technology, performance analytics, and their implications for the development of the concept of Smart Agility Test and Training with Integration Analysis (SATRIA).

3.2 Literature Search Strategy

Article searches were conducted systematically on four reputable international scientific databases in the field of sports and health sciences, namely Scopus, Web of Science, PubMed and Google Scholar. The search was conducted in the period January–February 2026, while the articles analyzed were publications between January 2016 and December 2025. A ten-year time frame was chosen to describe the latest developments in agility, reactive agility, and sports technology. The search strategy uses a combination of Boolean operators (AND and OR) as follows ("Agility Test" OR "Reactive Agility") AND ("Agility Training") AND ("Sport Technology" OR "Wearable Technology") AND ("Performance Analysis" OR "Performance Analytics")In addition, additional searches are conducted using keywords: Smart Agility, Digital Agility Assessment, Agility Measurement, Cognitive Agility, Decision Making in Sport and Sports Performance Technology. All search results are exported into the Mendeley Desktop software to manage references and identify duplicate articles.

3.3 Inclusion and Exclusion Criteria

The selection of articles is carried out based on the inclusion and exclusion criteria that have been set before the literature search process. Articles are selected if they meet all of the following requirements. The article is the result of research published in a peer-reviewed scientific journal, Published in 2016–2025, Written in English or Indonesian, Available in full-text form, Cover one or more of the following topics: agility test, reactive agility, change of direction, agility training, performance analysis and Sport Technology, It has relevance to the development of the concept of Smart Agility Test and Training with Integration Analysis (SATRIA). The article selection process follows four main stages in the PRISMA 2020 guidelines (Page et al., 2021), namely Stage 1. Identification all articles are obtained through searches on electronic databases using predetermined keywords. Articles from across databases are then combined into a single reference database. Stage 2. Screening at this stage, duplicate articles are deleted, then continued with filtering based on titles and abstracts according to inclusion and exclusion criteria. Stage 3. Eligibility Assessment articles that pass the screening stage are read in full (full-text review) to assess suitability for the purpose of the research. Stage 4. Inclusions articles that meet all the requirements are included in the literature synthesis process.

3.4 Data Collection Procedures

Data collection is carried out systematically using a pre-arranged extraction sheet. The information gathered from each article includes author's name; year of publication; the country of origin of the research; research design; sample characteristics; agility instruments used; the type of technology applied; the variables measured; the main results of the study; implications for the development of Smart Agility. The data is then compiled in the form of a synthesis table to facilitate the analysis and comparison process between studies.

To ensure the quality of the scientific evidence, each article that met the inclusion criteria was evaluated using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist, which was tailored to the design of the individual study

(Aromataris & Munn, 2020). The assessment includes clarity of research objectives, suitability of methods, validity of instruments, data analysis, and consistency of reporting results.
Only articles of medium to high methodological quality are retained in the synthesis processDescribe step-by-step how data were collected. Include information about any interventions, treatments, or conditions. Mention ethical approvals and consent procedures.

3.5 Data Analysis

The data were analyzed using a thematic synthesis approach as explained by Thomas and Harden (2008). The analysis process is carried out through three stages, namely Open coding, to identify the main concepts of each article, Thematic grouping, based on the similarity of research characteristics, Narrative synthesis, to integrate research results into a conceptual framework for the development of Smart Agility Test and Training with Integration Analysis (SATRIA). Based on the synthesis process, the article is grouped into five main themes the concept and definition of agility, development of agility test instruments, agility training method, the application of digital technology in sports performance evaluation and conceptual model of Smart Agility Test and Training with Integration Analysis (SATRIA) (Rico-gonzález et al., 2022).

4. RESULTS

The process of identifying articles is carried out through four scientific databases, namely Scopus, Web of Science, PubMed, and Google Scholar, using a predetermined combination of keywords. Based on the initial search results, 686 articles relevant to the research topic were obtained. After the removal of as many duplicate articles as possible, there are 374 articles that have entered the screening stage based on titles and abstracts.
Table 1. the search results

PRISMA Stages	Number of Articles
Identified articles	686
Articles after duplicates are removed	374
Article after screening title and abstract	184
Rated full-text articles	107
Articles that meet the inclusion criteria	52

The screening stage produced 184 articles that met the initial criteria. Furthermore, a full-text review of all articles was carried out. A total of 107 articles were issued for not meeting the inclusion criteria, such as not specifically addressing agility, not using empirical research methods, not discussing sports technology, or only in the form of conference proceedings. In the final stage, 52 articles were obtained that met all the criteria and were used as the main source of the literature synthesis. The article selection process follows the PRISMA 2020 guidelines as shown in table 1.

A total of 52 articles that met the inclusion criteria were published between 2016 and 2025. There has been a consistent increase in the number of publications in the last five years, indicating an increasing focus on research on agility, reactive agility, and sports technology.
Most of the research comes from countries that have strong sports research traditions, such as Australia, the United States, the United Kingdom, Spain, Canada, China, and Germany. Based on the research design, the articles analyzed consisted.
Table 2. Research design

Research design	Quantity	Percentage
Experimental	22	42,3%
Cross-sectional	11	21,2%
Systematic Review	8	15,4%
Longitudinal	6	11,5%
Instrument Validation	5	9,6%

Most of the research involved athletes in game sports such as football, basketball, handball, rugby, futsal, tennis, and badminton. Some studies also involved sports students, young age athletes, and the general population.

The thematic analysis of 52 articles resulted in five main themes that became the basis for the development of the concept of Smart Agility Test and Training with Integration Analysis (SATRIA).
Table 3. Thematic analysis of 52 articles resulted.

Theme	Number of Articles
Modern agility concept	12
Agility test	15
Reactive agility	9

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Agility training	8
Sport technology & performance analytics	8

The results of the synthesis show that the definition of agility has undergone significant development in the last two decades. Initially, agility was understood as the ability to change the direction of the body quickly (change of direction speed). However, recent studies have shown that agility is a multidimensional ability that involves the interaction between physical components, visual perception, decision-making, neuromuscular coordination, and reaction time (Sheppard & Young, 2006). Most articles assert that change of direction and agility are two different constructs. Changes in direction are more influenced by biomechanical abilities and physical capacity, while agility involves the process of perception of external stimuli and decision-making before the movement is executed (Paul et al., 2016). These findings suggest that agility measurement should not only be oriented towards the time of completion of the test, but also consider the cognitive processes that occur during the execution of movements. These instruments have high reliability to measure the ability to change direction, but almost all studies report that they do not involve external stimuli and are therefore less able to describe the actual match situation (Young & Farrow, 2013). In contrast, research on the Reactive Agility Test shows that the use of visual and auditory stimuli increases the ecological validity of measurements because they are closer to the actual demands of the competition (Theobald et al., 2024).

A total of nine articles discuss the development of Reactive Agility as a new paradigm in agility measurement. Reactive agility involves three main stage identification of stimulus, decision-making and implementation of movements (Zhao et al., 2026). This approach allows for a more comprehensive measurement of athletes' abilities than conventional agility tests. In addition, several studies have shown that reaction time contributes significantly to agility performance, especially in sports that have fast game characteristics such as football, tennis, basketball, and futsal (Paul et al., 2016). The results of the synthesis show that the agility training method has also undergone considerable changes. Modern agility exercises no longer use only cone drills and ladder drills, but have evolved into exercises that integrate sprint, acceleration, deceleration, reaction Drill , visual stimulus, decision-Making and perception–action coupling. Most studies report that stimulus-based exercises result in greater improvements in reactive agility performance than pre-planned direction-change exercises (Zhao et al., 2025).

Eight articles discuss the use of digital technology in sports performance evaluation. The most widely used technologies include Wearable Sensor, inertial measurement unit (IMU), Optical Motion Capture, GPS, Artificial Intelligence, Cloud Database and Performance Dashboard The use of this technology allows the evaluation process to be carried out automatically with a higher level of objectivity than manual measurement. In addition to generating test completion time, the digital system is able to provide information.

5. DISCUSSION

The results of a systematic review show that research on agility has undergone significant development in the last two decades. These developments are not only seen in the change in the definition of agility, but also in measurement methods, training approaches, and the integration of digital technology in the evaluation of athlete performance. A synthesis of 52 articles shows that there is a paradigm shift from an approach oriented towards a multidimensional concept of agility that integrates physical, cognitive, and analytical technology capabilities. These findings provide a scientific basis for the development of Smart Agility Test and Training with Integration Analysis (SATRIA) as a more comprehensive model of agility evaluation and training.

The results of the synthesis show that most recent studies agree that agility can no longer be understood simply as the ability to change direction quickly. The definition put forward by Sheppard and Young (2006) states that agility is the ability to perform rapid movements throughout the body in response to an external stimulus. This definition places perceptual ability, decision-making, and reaction time as an integral part of agility performance.

These findings are reinforced by Paul et al. (2016), who stated that the ability to change of direction and agility are two different constructs. Change of direction is more influenced by physical capacities such as muscle strength, explosiveness, and movement technique, while agility involves the process of perception of the environment, information processing, and decision-making before the movement is made. Thus, the use of agility tests that only measure track completion time has not been able to fully describe the athlete's performance.

In the context of competitive sports, athletes must constantly respond to unpredictable changes in game situations. Therefore, the concept of reactive agility becomes more relevant than planned agility. This approach is in line with the theory of Ecological Dynamics, which explains that sports performance is the result of dynamic interactions between individuals, tasks, and the environment (Davids et al., 2013). Based on this theory, the ability to move quickly should always be associated with the ability to recognize stimuli and choose the right response.

The results of the review show that the Illinois Agility Test, T-Test, 505 Test, and Pro Agility Shuttle are still the most widely used instruments in research and coaching practice. These instruments have good reliability for measuring the speed of change of direction, but they have some fundamental limitations. First, the entire trajectory has been known by the participants before the implementation of the test so that decision-making ability is not evaluated. Second, the score produced is only in the form of completion time without providing information about movement quality, track efficiency, or reaction time. Third, most instruments still use manual recording so they are vulnerable to measurement errors (human error). These limitations indicate that conventional agility instruments have not fully met the increasingly complex demands of modern sports. Therefore, the development of digital technology-based instruments is an urgent need to improve the objectivity and accuracy of athlete performance evaluation.

One of the key findings of the synthesis results is the increasing attention to the role of cognitive abilities in agility performance. Various studies show that reaction time, selective attention, visual perception, and decision-making have a significant contribution to the success of athletes in making changes of direction effectively (Young & Farrow, 2013). These findings are in line with the Perception–Action Coupling Theory, which explains that perception and movement are two interrelated processes. The visual information received by the athlete will be processed in the central nervous system, then generate a motor response that corresponds to the game situation (Fajen et al., 2009). Therefore, high physical ability does not necessarily result in optimal agility performance if it is not supported by good cognitive ability. In the concept of Smart Agility Test and Training with Integration Analysis (SATRIA), the cognitive component is an integral part of the measurement process. The use of random visual stimuli allows participants to demonstrate perceptual abilities, information processing speed, and decision-making simultaneously with the execution of movements. This approach results in a more representative evaluation of the demands of the match than conventional agility tests.

The development of sports technology has opened up new opportunities in the evaluation of athletes' performance. The results of the review show that the use of inertial sensors (Inertial Measurement Units), artificial intelligence-based cameras, wearable devices, and cloud computing is increasingly being applied in sports research. Camomilla et al. (2018) explain that the use of digital sensors allows the measurement of various biomechanical parameters such as acceleration, deceleration, angular speed, step length, and movement efficiency with a high level of accuracy. In addition, data can be recorded automatically thereby reducing manual recording errors. In the concept of SATRIA, digital technology is not only used as a timekeeping tool, but also as an integrated performance analysis system. The test result data can be stored in a database, visualized through the dashboard, and compared to the norm or measurement results of previous measurements. This approach supports the application of evidence-based coaching, where the coach's decisions are based on objective data, rather than purely subjective observations.

A synthesis of all articles shows that there is no system that comprehensively integrates the processes of testing, training, and performance analysis in a single digital platform. Most studies focus only on one aspect, for example the validation of agility instruments, the effectiveness of training methods, or the development of motion evaluation technology. Based on these findings, this study proposes Smart Agility Test and Training with Integration Analysis (SATRIA) as a conceptual model that integrates five main dimensions, namely (1) Physical Agility, which measures acceleration, deceleration, and change of direction ability. (2) Reactive Agility, which evaluates the ability to respond quickly to external stimuli. (3) Cognitive Agility, which includes attention, visual perception, and decision-making. (4) Movement Quality, which assesses the efficiency, coordination, and accuracy of movements. (5) Digital Performance Analytics, which integrates automated logging, performance analysis, data visualization, and exercise recommendations. This model not only generates a performance score, but also provides diagnostic information that can be used to build an individual training program.

The results of this study have several practical implications. For coaches, SATRIA can be used as a more objective evaluation instrument to monitor athletes' progress and design training based on data. For physical education teachers, this system can be used as a tool for assessing movement skills that integrates physical and cognitive aspects. In the context of sports rehabilitation, Smart Agility-based evaluations can help monitor athletes' readiness to return to training or competing after an injury. In addition, the integration of digital technology opens up opportunities to build a cloud-based performance monitoring system, so that data can be accessed in real-time by coaches, researchers, and sports support personnel. This approach is in line with the development of Sports Analytics and Industry 5.0, which emphasizes the use of artificial intelligence and data analysis in decision-making(Men, 2022).

Although it provides a comprehensive synthesis, this study has some limitations. First, the literature analyzed only came from English and Indonesian articles, so there may be relevant research in other languages that were not identified. Second, most of the research reviewed still focuses on game sports, so generalizations to other sports need to be done carefully. Third, the concept of SATRIA proposed in this study is still conceptual and has not been empirically tested. Therefore, further research needs to develop and test the validity of the construct, reliability, and effectiveness of SATRIA in various age groups and sports. In addition, the integration of technologies such as machine learning, computer vision, and artificial intelligence can be the next development direction to produce a more adaptive and predictive agility evaluation system. The framework describes that the agility evaluation process takes place continuously (continuous assessment cycle). The data obtained during the test does not stop at the measurement stage, but is automatically analyzed to generate feedback that is used as the basis for the preparation of an adaptive training program. This approach is in line with the concept of evidence-based coaching, which is coaching decision-making based on objective data analysis(Susitha et al., 2024).

Compared to existing agility instruments, SATRIA offers some scientific novelties. First, the system integrates physical, cognitive, and digital components in one unified platform. Second, the use of random stimuli increases ecological validity because it more closely resembles real match conditions. Third, the evaluation is not only oriented to the time of completion of the test, but also to the quality of the movement process and response to the stimulus. Fourth, the integration of a digital dashboard allows the process of monitoring athlete development to be carried out longitudinally. Fifth, the system generates adaptive training recommendations that support the personalization of training programs based on the characteristics of each athlete.

Table 6. Comparison of Conventional Agility Instruments and SATRIA.

Aspects	Illinois Test	T-Test	Reactive Agility Test	SATRIA
Change of direction	✓	✓	✓	✓
Random stimulus	✗	✗	✓	✓
Reaction time	✗	✗	Partial	✓
Decision-making	✗	✗	✓	✓
Cognitive assessment	✗	✗	Partial	✓
Digital data acquisition	✗	✗	Partial	✓
Performance dashboard	✗	✗	✗	✓
Automatic analytics	✗	✗	✗	✓
Adaptive training recommendation	✗	✗	✗	✓
Longitudinal monitoring	✗	✗	Limited	✓

Based on the results of the literature synthesis, SATRIA is not intended to replace conventional agility instruments, but to complement and develop existing evaluation approaches through the integration of physical measurements, cognitive function, and digital analysis. Therefore, SATRIA can be positioned as a next-generation agility assessment framework, which not only functions as a performance measurement tool, but also as a decision support system in the athlete coaching process(Syamsir et al., 2025).

6. CONCLUSION

This Systematic Literature Review (SLR) provides a comprehensive synthesis of the development of the concepts of agility, reactive agility, agility training, and the use of digital technology in sports performance evaluation based on the PRISMA 2020 guidelines. The results of the study show that the agility paradigm has shifted from just the ability to change of direction speed to multidimensional abilities involving the interaction between physical capacity, visual perception, reaction time, decision-making, neuromuscular coordination, and movement quality. This paradigm shift confirms that modern agility measurement needs to evaluate physical and cognitive aspects simultaneously to better represent the actual demands of the game. A synthesis of the literature also shows that conventional agility instruments, such as the Illinois Agility Test, T-Test, 505 Agility Test, and Pro-Agility Shuttle Test, still have limitations because most only measure test completion time without considering stimulus response, movement quality, or overall performance analysis. Although the concept of reactive agility has improved the ecological validity of measurements through the use of external stimuli, the integration between testing, training, performance analysis, and digital data management processes has not been widely developed in a single integrated system.

Based on these findings, this study proposes Smart Agility Test and Training with Integration Analysis (SATRIA) as a new conceptual framework that integrates five main dimensions, namely physical agility, reactive agility, cognitive agility, movement quality, and digital performance analytics. The integration of these five dimensions results in a more comprehensive approach than conventional agility instruments because it not only measures the final result in the form of test completion time, but also analyzes the movement process, response to stimulus, performance quality, and longitudinal development of athletes through the support of digital technology. The main contribution of this research is the preparation of a proposed theoretical framework that connects agility theory, Ecological Dynamics, Perception–Action Coupling, Motor Learning, and Sports Technology into a single data-based agility evaluation and training model. The conceptual framework expands the perspective of agility evaluation from an outcome-based approach to one that integrates process-based assessment, performance analysis, and evidence-based coaching). Thus, SATRIA is expected to be one of the innovations in the digital technology-based agility evaluation and training system that supports the development of athletes in a more objective, adaptive, and sustainable manner.

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AUTHOR CONTRIBUTIONS

Author	Contribution (CRediT Taxonomy)
First Author	Conceptualization, Methodology, Data Curation, Writing – Original Draft
Second Author	Investigation, Formal Analysis, Resources
Third Author	Supervision, Writing – Review & Editing, Funding Acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

REFERENCES

Camomilla, V., Bergamini, E., Fantozzi, S., & Vannozzi, G. (2018). Trends supporting the in-field use of wearable inertial sensors for sport performance evaluation: A systematic review. Sensors, 18(3), 873. https://doi.org/10.3390/s18030873

Davids, K., Button, C., & Bennett, S. (2013). Dynamics of Skill Acquisition: A Constraints-Led Approach. Human Kinetics.

Fajen, B. R., Riley, M. A., & Turvey, M. T. (2009). Information, affordances, and the control of action in sport. International Journal of Sport Psychology, 40(1), 79–107.

Paul, D. J., Gabbett, T. J., & Nassis, G. P. (2016). Agility in team sports: Testing, training and factors affecting performance. Sports Medicine, 46(3), 421–442. https://doi.org/10.1007/s40279-015-0428-2

Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. Journal of Sports Sciences, 24(9), 919–932. https://doi.org/10.1080/02640410500457109

Young, W. B., & Farrow, D. (2013). A review of agility: Practical applications for strength and conditioning. Strength and Conditioning Journal, 35(5), 24–29.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

Paul, D. J., Gabbett, T. J., & Nassis, G. P. (2016). Agility in team sports: Testing, training and factors affecting performance. Sports Medicine, 46(3), 421–442. https://doi.org/10.1007/s40279-015-0428-2

Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. Journal of Sports Sciences, 24(9), 919–932. https://doi.org/10.1080/02640410500457109

Young, W. B., & Farrow, D. (2013). A review of agility: Practical applications for strength and conditioning. Strength and Conditioning Journal, 35(5), 24–29.

Zhao, Z., et al. (2025). Optimizing agility training in team sport players: The role of perception–action coupling. Journal of Sports Science & Medicine.

Aromataris, E., & Munn, Z. (Eds.). (2020). JBI Manual for Evidence Synthesis. Joanna Briggs Institute. https://doi.org/10.46658/JBIMES-20-01

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Medical Research Methodology, 8, 45. https://doi.org/10.1186/1471-2288-8-45

Baca, A., & Kornfeind, P. (2012). Rapid feedback systems for elite sports training. IEEE Pervasive Computing, 11(4), 70–76. https://doi.org/10.1109/MPRV.2011.79

Camomilla, V., Bergamini, E., Fantozzi, S., & Vannozzi, G. (2018). Trends supporting the in-field use of wearable inertial sensors for sport performance evaluation: A systematic review. Sensors, 18(3), 873. https://doi.org/10.3390/s18030873

Moreno, M., et al. (2022). Assessing the reliability and validity of agility testing in team sports: A systematic review. Journal of Strength and Conditioning Research, 36(7), 2035–2049. https://doi.org/10.1519/JSC.0000000000003753

Page, M. J., McKenzie, J. E., Bossuyt, P. M., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

Paul, D. J., Gabbett, T. J., & Nassis, G. P. (2016). Agility in team sports: Testing, training and factors affecting performance. Sports Medicine, 46(3), 421–442. https://doi.org/10.1007/s40279-015-0428-2

Peake, J. M., Kerr, G., & Sullivan, J. P. (2018). A critical review of consumer wearables, mobile applications, and equipment for providing biofeedback, monitoring stress, and sleep in physically active populations. Frontiers in Physiology, 9, 743. https://doi.org/10.3389/fphys.2018.00743

Rein, R., & Memmert, D. (2016). Big data and tactical analysis in elite soccer: Future challenges and opportunities. SpringerPlus, 5, 1410. https://doi.org/10.1186/s40064-016-3108-2

Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. Journal of Sports Sciences, 24(9), 919–932. https://doi.org/10.1080/02640410500457109

Young, W. B., & Farrow, D. (2013). A review of agility: Practical applications for strength and conditioning. Strength and Conditioning Journal, 35(5), 24–29. https://doi.org/10.1519/SSC.0b013e3182a4c53a

Young, W. B., Dawson, B., & Henry, G. J. (2015). Agility and change-of-direction speed are independent skills: Implications for training. Strength and Conditioning Journal, 37(1), 52–59. https://doi.org/10.1519/SSC.0000000000000115

Camomilla, V., Bergamini, E., Fantozzi, S., & Vannozzi, G. (2018). Trends supporting the in-field use of wearable inertial sensors for sport performance evaluation: A systematic review. Sensors, 18(3), 873. https://doi.org/10.3390/s18030873

Davids, K., Button, C., & Bennett, S. (2013). Dynamics of Skill Acquisition: A Constraints-Led Approach. Human Kinetics.

Fajen, B. R., Riley, M. A., & Turvey, M. T. (2009). Information, affordances, and the control of action in sport. International Journal of Sport Psychology, 40(1), 79–107.

Paul, D. J., Gabbett, T. J., & Nassis, G. P. (2016). Agility in team sports: Testing, training and factors affecting performance. Sports Medicine, 46(3), 421–442. https://doi.org/10.1007/s40279-015-0428-2

Schmidt, R. A., & Lee, T. D. (2019). Motor Learning and Performance: From Principles to Application (6th ed.). Human Kinetics.

Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. Journal of Sports Sciences, 24(9), 919–932. https://doi.org/10.1080/02640410500457109

Young, W. B., & Farrow, D. (2013). A review of agility: Practical applications for strength and conditioning. Strength and Conditioning Journal, 35(5), 24–29. https://doi.org/10.1519/SSC.0b013e3182a4c53a

Men, R. (2022). *Validity of the Polar H10 Sensor for Heart Rate Variability Recreational Men and Women*.

Rico-gonzález, A. M., Pino-ortega, J., Clemente, F. M., & Arcos, A. L. (2022). *Guidelines for performing systematic reviews in sports science*.

Susitha, E., Jayarathna, A., & Herath, H. M. R. P. (2024). Supply Chain Analytics Supply chain competitiveness through agility and digital technology : A bibliometric analysis. *Supply Chain Analytics*, *7*(June), 100073. https://doi.org/10.1016/j.sca.2024.100073

Syamsir, S., Saputra, N., & Mulia, R. A. (2025). Leadership agility in a VUCA world : a systematic review , conceptual insights , and research directions. *Cogent Business & Management*, *12*(1). https://doi.org/10.1080/23311975.2025.2482022

Theobald, P., Herold, F., Gronwald, T., & Müller, N. G. (2024). Remote fitness assessment in younger and middle - aged to older adults : a comparison between laboratory - and videoconference - based assessment of selected measures of physical and cognitive fitness. *BMC Sports Science, Medicine and Rehabilitation*, *4*. https://doi.org/10.1186/s13102-024-00985-4

Zhao, Z., Liu, Y., & Xu, K. (2026). *Optimizing Agility Training in Team Sport Players — The Role of Perception- Action Coupling : A Systematic Review with Multi-Level Meta-Analysis*. *February*, 84–111.

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