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Role of Technology in Paralympic Sports and Performance of India in Paralympics

Priyanka Poonia
Research Scholar,
Department of Physical Education,
C.R.S.U. - Jind, Haryana, India.

Abstract: ***Actually, when it comes to sports, technology's role is a frequent topic of discussion. However, in the context of the Paralympics, this discussion becomes particularly complex due to the clear and significant connection between athletes and assistive devices. Individuals with impairments often depend on a range of assistive devices not only in their daily lives but also to excel in sports. The integration of technological innovations into sports often sparks controversy because these advancements can have a profound impact on the nature of Paralympic events and the strategies employed by athletes. The extent to which these assistive devices are utilised can vary greatly, with some athletes relying heavily on them while others use them sparingly. Over the past few decades, technological advancements in the Paralympic Games have played a significant role in enhancing the athletic experiences of individual competitors. This paper's primary objective is to examine and describe the most recent technological advancements in the Paralympic Games including the performance of India in Paralympics.***

Keywords: ***Paralympic sports, technological developments, Athletes, performance, physical prowess.***

Introduction:

All of us know that sports represent a voluntary endeavour to overcome challenging obstacles, requiring a delicate equilibrium between the rigidity of these barriers and the desire to break records, enhance self-efficiency, uphold traditional values, and embrace new technologies. This endeavour entails adhering to rules and regulations while maximising one's potential and ensuring equal opportunities despite significant disparities. The core principle of the Paralympics is to offer all athletes, regardless of social conditions, an equal chance for success, based on their talent, determination, and abilities. Evidently, numerous examples demonstrate a remarkable rise in participation and performance levels. Notably, the progression of records and participation in the T44 category IV (from 1972 to 2012) for the 100 metres sprint has outpaced that of the Olympic competition. The Paralympics serve as an inclusive platform for para-athletes to showcase their physical prowess, highlighting differences in talent, skills, and dedication. Moreover, it is imperative to encourage widespread participation, ensuring that the Paralympics are not confined to developed nations or those with ample resources. To achieve this, certain criteria, such as FINA's decision to ban high-tech and expensive swimsuits, which can introduce technological inequalities of little importance to the competition, must be balanced to provide more meaningful opportunities for people with impairments.

The term "Paralympic" derives its meaning from "Parallel," signifying an event occurring concurrently with the Olympics. Today, the primary goal of Paralympic sports is to promote increased participation and equitable opportunities for disabled athletes. The use of specific equipment in various sports necessitates an assessment of its impact on athletes' performances. It is crucial to ensure that success depends on an athlete's ability to fully express their talents, with assistive devices not unfairly enhancing their performance. Standard assistive devices can hinder Paralympians in performing the demanding activities of

their sports. While many Paralympic sports require technologies akin to their Olympic counterparts, ongoing technological advancements in wheelchair devices and prosthetics are essential for the continued development of Paralympic athletes.

A Brief History of Paralympics:

The inaugural Paralympic Games made their debut in Rome in 1960, with the participation of just 400 athletes representing 23 countries. During this period, the Paralympic Games had not yet gained recognition as an independent sporting event. Fast forward to the 2008 Beijing Games, and a remarkable transformation had occurred. Over 4,000 athletes with various impairments, hailing from 148 different countries, came together on the world stage. This significant expansion altered the global perception of the Paralympic Games, elevating their status. However, it remained evident that the Paralympics still trailed behind the Olympics in terms of overall participation. The number of athletes in the Paralympic Games was only about one-third of the Olympic Games, primarily due to the prevailing societal prejudices surrounding disabilities. Nonetheless, this burgeoning interest in the Paralympic Games marked a significant milestone in showcasing the full potential of individuals with disabilities.

The organisation and administration of the Paralympic Games, as well as quadrennial World Championships for specific Paralympic sports like athletics, are overseen by the International Paralympic Committee (IPC) for Sport for the Disabled (IOSD). This governing body encompasses athletes, administrators, and classification systems. According to the IPC, the Paralympic Games are recognized as the foremost and universally acknowledged event aimed at empowering and uplifting athletes with disabilities on a global scale.

Technology in Paralympic Sports:

The term "Technology" refers to the skillful application of strategies and tools in a comprehensive manner, primarily designed for practical use. It involves the utilization of expert knowledge related to physiological movement, biomechanics, and technical-tactical elements in the context of training and competition. This knowledge is instrumental in creating ergogenic support, especially in the development of sports attire and equipment, as well as the incorporation of sensors for data collection. Advanced software plays a crucial role in identifying areas for improvement and enhancement.

Athletes who embrace cutting-edge devices experience significant enhancements in their competitive performance, often leading to secured victories. These aids take on various forms, such as bicycles and rackets, which are essential in their respective sports, as well as protective gear designed for specific tasks. Additionally, there are specialised clothing options to consider. It's worth noting that similar equipment may serve different functions in various sports. For instance, in football, shoes are mandatory equipment, serving to protect the athletes' feet and improve ball control. Conversely, in athletics, their role is more about facilitation, and athletes have the liberty to compete barefoot. In some Paralympic sports, athletes are allowed to use prostheses. However, it's imperative to adhere to Rule 7.2 of Paralympic Sport, which strictly prohibits unnecessary prostheses and assistive devices designed to enhance an athlete's performance beyond their natural abilities and established standards.

Today the use of technology to promote sports equality among participants with impairments in the Paralympics is a multifaceted issue. In theory, advancing technology in the future could help reduce disparities and enable athletes to compete without facing discrimination based on differences in skill and talent, thereby enhancing their performance. Technological advancements have not only occurred in the fields of medical and rehabilitation but also in sports experimentation.

The core principle of Paralympic sports is to support the well-being of athletes, foster sports development, and improve athletes' overall quality of life. This mission extends beyond sports and aims to strengthen the Paralympic movement through robust classification systems, changing societal attitudes towards individuals with disabilities, celebrating diversity, and contributing to a more sustainable and improved world. It can be argued that the use of technology is acceptable, but only if it aligns with these overarching sports-related goals. In the promotion of Paralympic sports, technology has presented numerous opportunities and challenges for the International Paralympic Committee (IPC) and the broader community of disabled athletes.

Recent Technological Developments and Paralympic Sports :

- **Wheelchair Racing :** The development of wheelchair equipment faced limitations from the 1940s until the 1990s, which hindered progress in designing racing wheelchairs. Recent advancements in racing wheelchair design have primarily focused on optimising speed. These modern racing wheelchairs feature an elongated wheelbase, oversized rear wheels, a forward-leaning bucket seat, and compact hand rims. Three methods are used for steering racing wheelchairs: (i) handlebar usage, (ii) compensator-based steering, and (iii) performing a wheelie.

Substantial modifications have been made to the initial designs of wheelchairs used in early wheelchair racing. A significant amount of research has been dedicated to enhancing racing wheelchair design by incorporating advanced materials such as titanium and carbon fibre. This research takes into account factors like rolling resistance and aerodynamics.

- **Hand Cycling:** The genesis of hand cycling can be traced back to the aspirations of individuals with disabilities who wished to compete on equal footing with non-disabled athletes. Within the framework of The Paralympic Games, two categories of hand cycles are sanctioned: Kneeling Hand Cycles and Recumbent Hand Cycles. Hand cycles designed for racing purposes commonly feature an extensive gear selection, ranging from 1 to 33 gears. These cutting-edge racing machines are meticulously crafted using top-tier materials like Titanium, Aluminum, and carbon fibre.

- **Cycling:** In the world of cycling, visually impaired athletes utilise tandem assistive devices identical to those used by their able-bodied counterparts. A wide range of prosthetic options has been developed to facilitate the participation of disabled athletes in this sport. Specifically, leg and arm prosthetics enable these athletes to ride the same type of bicycles as able-bodied individuals.

The cost of prosthetics required for cycling is generally high, primarily due to the use of advanced materials like carbon fibre in their construction. As a result, there is an ongoing effort to reduce the manufacturing costs of these prosthetic devices. This includes the exploration of new materials and techniques, such as 3D printing, with the ultimate goal of improving accessibility and safety for athletes in the sport.

- **Wheelchair Basketball:** Wheelchair basketball is essentially a modified variant of the traditional game played by able-bodied individuals. Since its inception in 1946, there have been significant advancements in wheelchair technology. Contemporary wheelchairs used in this sport are equipped with advanced safety wheels to protect players' hands from potential injuries. Additionally, these wheelchairs have been adapted with rear caster wheels to prevent tipping backward. High-quality materials such as titanium and carbon fibre are now employed in the construction of seats, spokes, and frames of these wheelchairs, ensuring both performance and longevity.

- **Shooting:** Shooting is a precision-intensive sport that places high demands on athletes' control and accuracy. What's remarkable is that athletes with disabilities can actively participate in rifle and pistol events within the Paralympic shooting discipline. These athletes use the same firearms and attire as their able-bodied counterparts, but with specific equipment adaptations to cater to their unique requirements. These adaptations primarily involve providing additional support for pistols and rifles, as well as integrating assistive devices to assist visually impaired athletes in targeting.

In recent years, significant technological advancements have opened up new opportunities for visually impaired athletes to excel in shooting competitions. One noteworthy innovation involves the use of audio signals with varying intensity and pitch to gauge proximity to the target, enabling athletes to enhance their aiming precision. Cutting-edge techniques, such as the Ecoaims VIS500 that employs infrared LEDs, have been seamlessly incorporated into the sport. These devices are strategically positioned above the target and seamlessly interact with a camera component within the aiming apparatus. Participants in these events utilise specially designed wheelchairs that adhere to stringent regulations established by the governing body. These wheelchairs are characterised by their relatively low back support and absence of armrests, emphasising mobility and adaptability. Furthermore, mechanical supports are provided to help shooters stabilise their rifles during competition.

- **Wheelchair Rugby:** Wheelchair rugby, which made its debut as a demonstration sport at the 1996 Atlanta Paralympic Games, was officially recognized as a medal sport at the 2000 Sydney Paralympic Games. The specially designed wheelchairs used in this sport possess unique characteristics:

1. Enhanced backrests to assist with trunk control.
2. Increased tilt to prevent forward tipping, facilitating ball handling.
3. Wheel spoke covers for added protection.
4. Frontal metal guards for player safety.
5. Elevated wheel camber to reduce the risk of hand injuries.

The wheelchairs utilised in the 1996 Paralympic Games differed significantly from those employed in the 2000 Paralympic Games. In 1996, they closely resembled the wheelchairs used in wheelchair basketball. These wheelchair designs also play a crucial role in specific defensive and offensive strategies, necessitating only minor adjustments. Offensive chairs often incorporate shrouds to impede opponents, while defensive chairs feature front bumpers to obstruct the progress of the opposition.

- **Para-Archery:** This sport has been a part of the Paralympic Games since its inception in 1960. It is open to athletes with physical disabilities who can utilise assistive devices permitted by the IPC's classification rules. Some approved adaptations include:

1. Mechanical releases can be employed on the bow.
2. Individuals with arm movement difficulties can opt for mouth slings, tabs, or mounts.
3. An assistant can aid in conveying information about arrow placement on the target or assist with knocking the arrow onto the bow.
4. Strapping is also permitted to assist in securing the body to the wheelchair.
5. Vision-related assistive aids are welcomed.
6. Prosthetic aids with specialised attachments are permitted.
7. Wheelchairs with enhanced back support are also allowed.

Performance of India in Paralympics:

Table 1: Medal list of India in Paralympics (1972-2021)

Sr. No.	Year	Gold	Silver	Bronze	Total
1	1972	1	0	0	1
2	1984	0	2	2	4
3	2004	1	0	1	2
4	2012	0	1	0	1
5	2016	2	1	1	4
6	2021	5	8	6	19

The table above serves as compelling evidence of a significant increase in Paralympic participation, directly attributable to advancements in technology. Notably, this table offers a year-to-year comparison of the accomplishments of Indian athletes at

the Paralympic events. This comparative analysis unmistakably reveals a substantial surge in medal tallies, particularly from the previous year to the latest Tokyo 2021 Paralympics. This remarkable growth in achievements can be solely attributed to the integration of technology and the provision of various assistive resources to athletes in recent times. In light of these observations, it is irrefutable that technology has played a pivotal role in enhancing the performance of these athletes.

Table 2: Sports-wise Medal List

Sr. No.	Sports	Gold	Silver	Bronze	Total
1	Table Tennis	0	1	0	1
2	Swimming	1	0	0	1
3	Badminton	2	1	1	4
4	Archery	0	0	1	1
5	Shooting	2	1	2	5
6	Powerlifting	0	0	1	1
7	Athletics	4	9	5	18

The provided table furnishes a sport-specific analysis of Indian athletes' accomplishments in the Paralympic Games since its inception. As such, when designing technology and assistive tools, it is imperative to consider these four key factors. The core ethos of the Paralympics revolves around ensuring equitable access to technology, prioritising safety and impartiality, and, most significantly, refraining from augmenting an athlete's performance beyond their actual physical capabilities.

Concluding Remarks:

Now we come to conclude that Para-athletes have access to cutting-edge technology, their pursuit of peak performance in high-level sports demands rigorous training and the ability to navigate complex equipment challenges. These exceptional athletes serve as catalysts for technological advancement and economic investments, strategically engaging fans through their gameplay to maintain a profound social impact. Initially, the prohibitively high development costs of such equipment made them inaccessible to many. However, as the Paralympics gained global prominence, increased participation and funding led to a significant reduction in equipment costs.

The International Paralympic Committee (IPC) plays a crucial role in ensuring fairness and eradicating inequalities. To determine whether assistive devices provide unfair advantages or reasonable compensation to athletes, various medical and biomechanical tools are employed. The concept of disability is inherently subjective, making it challenging to draw clear distinctions between abilities and disabilities. Conducting comprehensive surveys, both qualitative and quantitative, to gauge Para-athletes' perspectives on issues like discrimination and societal attitudes can inform decisions regarding the equitable use of technology to prevent unfair competition.

As spectators, it's essential for us to shift our focus toward recognizing the innate potential of these athletes rather than fixating solely on the technology they utilise. These technological tools serve as aids to support these athletes who still face gruelling and demanding journeys in their relentless pursuit of excellence.

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