ATHLETICS REPORT

This report does not contain any graphs. It is meant to be an extremely quick document where to find all the information that is expressed also in other documents. In particular, we suggest viewing the following documents:

- Complete report, with graphical analysis: folder rmarkdown, file sport_data_analytics_report.html
- Interactive R-Shiny application: folder shiny, files development_athletes.R, app_athletic_trends, sport_data_shiny

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GENERAL KNOWLEDGE ABOUT ATHLETICS

The main purpose of this report is to inform, analyse and suggest planning actions for the Swiss Federation. We are going to take into consideration 4 different disciplines in athletics. In particular, we are going to dive deeply into 100m, 200m, 400m and long jump. First of all we would like to give the context, explain the general aspects of each discipline.

1. 100m

Athletes competing in the 100-metre sprint must cover the distance in a straight line as quickly as they can. Athletes sprint off the line and pick up speed quickly to get to and maintain their top speed. Timing is done in hundredths of seconds, and the winner is the first competitor to cross the finish line. The 100-metre sprint calls for a lot of physical stamina, quickness, and explosive power in addition to coordination and technique. The start is important because a poor start or an incorrect starting position can cost vital tenths of a second. One of the most prestigious events in athletics is the 100-metre sprint, which is frequently referred to as the “supreme discipline.”

1.1. Men’s 100 m

An analysis of times in the men’s 100m sprint at the Olympic Games and World Championships in Athletics from 1930 to the present shows that running times have continued to improve over the years. In the early 1930s through 1956, the average time for the third-place runner was 10.4 to 10.6 seconds. In the 1960s, the time for a medal was lowered to 10.1 seconds. After that, for the next ten years, it was possible to win a bronze medal with a faster time than 10.1 seconds. Starting in 1986, the times for a podium finish dropped dramatically and continued to evolve until today. Since 2012, a time of under 10.00 must be achieved to be considered for a medal. However, it should also be noted that the times from 1930 to 1986 have evolved much more dramatically than from 1986 to the present, which may indicate that the human (man) factor is reaching its limits.

1.2. Women’s 100 m

In women’s 100m sprint, a similar pattern to the men’s can also be seen when observing the data. Here, too, one sees a steady improvement in times from 1930 to the present. From 1932 to 1956, times ranged from 12 to 11.70 seconds for a 3rd place finish at a major event. After that, the time decreased

steadily to 11.24 seconds until 1968, which represents an improvement of about 4%. From the year 1968 until today the times for the bronze place developed continuously to 10.76 seconds. This means that the athlete who won a bronze medal in 1968 must be about 4.27% faster today.

2. 200 m

The 200-metre race is one of the disciplines in athletics that are in the sprint area. The distance is 200 metres and the athletes start from a starting block. In a 200-metre race, the athletes must run a curve before getting onto the straight. The turn is usually tighter than the straight, which means that the athletes have to run tighter and can slow down their speed a bit. After the turn, athletes accelerate on the straight and try to reach and maintain their top speed to win the race. There are special techniques that sprinters use to maintain their speed. For example, they may keep their arms close to their body and take quick, short strides to run faster. Good sprinting technique can make the difference between winning and losing. The 200-metre dash is an exciting race because it requires a combination of speed, strength and technique. It also requires excellent physical conditioning, as athletes must maintain their maximum speed over a longer distance than in the 100-metre run.

2.1. Men's 200 m

In 1932, the time of 21.50 seconds was enough to win a medal. Over the years, the athlete's times continued to develop, so that the time of 20.10 seconds was broken in 1968 by a bronze medalist. This means that it took 36 years to improve the bronze time of 1932 by about 6.6%. From then on, the improvement was volatile in the range of 19.74 seconds.

2.2. Women's 200 m

When looking at the 3rd place times, a similar pattern can be identified for both men and women. From the year 1948 to 1968, the times improved rapidly from 25.20 to 22.88 seconds (- 9.02%). After that, the times develop volatile between the ranges 22.88 and 21.87 seconds.

3. 400 m

The 400-metre race is one of the most demanding disciplines in the track and field sprint section. In this discipline, athletes also start from a starting block and run once around the stadium track, which corresponds to a distance of 400 metres. Athletes must perfect their speed and endurance during the race, as they must sprint for a longer time than in the 200-metre race. The race usually begins with a quick acceleration from the starting block, followed by a sustained top speed through the first turn. Then athletes enter the straightaway and must continue to maintain their pace while doing their best to reach the finish line. A successful 400-metre runner needs excellent conditioning to achieve the speed and endurance required. It also requires good technique to ensure that the athlete uses their energy efficiently and can maintain their speed without exhausting themselves. The 400-metre course is known for demanding everything from the athletes, especially in the last 100 metres when they have to move towards the finish line and give their maximum. The 400-metre race is an exhilarating event that requires both physical and mental strength and is often considered one of the most difficult events in track and field.

3.1. Men's 400 m

In the men's 400m, times for a bronze medal ranged from 47.40 to 46.80 seconds from the early 1930s to 1956. Subsequently, the times for a podium

finish developed steadily, so that in 1968 the time of 40.41 seconds was set by a third-place finisher. From the year 1968 until today the times improved discontinuously and the results moved in the range of 43.85 to 45.25 seconds. From this it can be concluded that the third place finisher in 1968 would also have a chance to win a medal in the 2000s.

3.2. Women's 400 m

The women's 400m race was held for the first time at the 1964 Tokyo Olympics. In the first event, the third-place finisher clocked a time of 53.40 seconds. At the 1984 Olympics, a time of 49.62 seconds was needed to win a medal. After that, the times were mainly in the range of 49.46 to 50.45 seconds, with the exception of the bronze time of 49.10 seconds at the 1996 Olympics.

4. Long Jump

The long jump is one of the disciplines in track and field where the goal is to jump as far as possible. The athlete starts from a marker on a run-up track and then jumps into a sandbox. The long jump begins with the run-up, where the athlete picks up speed and then jumps from the take-off board. During the run-up, it is important for the athlete to maintain speed and rhythm in order to achieve the best possible distance at the jump. During the jump itself, the athlete must stay in the air and jump as far as possible before landing in the sandbox. There are special techniques that a long jumper can use to maximise their jumping distance. For example, they can position their arms and legs at certain angles to create more momentum and height. After landing in the sandbox, the distance is measured by measuring the distance from the jump board to where the athlete landed in the sand. If an athlete exceeds the distance of another athlete, he wins the race. The long jump requires a combination of speed, power and technique, and the best long jumpers are able to perfect these elements to maximise their performance. It is also a very visual and exciting discipline, as spectators can watch athletes sprint through the run-up lane at great speed and leap into the air before landing in the sand.

4.1. Men's Long Jump

From the 1930s to the late 1950s, the distances of bronze medalists ranged from 7.30 to 7.48 metres. From 1968 until today, the jump distances of the bronze medalists developed in the range of 8.03 metres to 8.42 metres.

4.2. Women's Long Jump

At the 1948 and 1952 Olympics, the respective bronze medalists achieved a distance of 5.52 metres and 5.92 metres. In 1983, at the World Championships, the third-placed athlete jumped a distance of 7.04 metres. From that year until today, the distances of the third-placed athlete at a major event have ranged between 6.69 metres and 7.08 metres.

5. Conclusion

The improvement in track and field times can be attributed to several factors, including improvements in training methodology and nutrition, as well as advances in technology and materials of starting blocks and running shoes. It is also interesting to note that in recent decades there has been some controversy regarding the performance of athletes who have doped. However, anti-doping campaigns have intensified in recent years, which has helped improve the sport's credibility and integrity. Overall, performance development in athletics has been amazing over the past 90 years, and best times are likely to continue to improve as athletes and

scientists continue to work hard to find new ways to overcome the limits of human performance.

ATHLETICS RESULT TRENDS: SWITZERLAND COMPARED TO THE WORLD BEST

1. 100m

1.1. Men's 100 m

If we're taking a closer look at the 100m men, we can see that in the past 2022 it was necessary to run under 10 seconds to have a chance for a gold medal. Only in 2003 a gold medal was achieved with a time over 10 seconds. Nevertheless, a certificate at World Championships or Olympic Games was possible with a time over, but close to, 10 seconds. In 2021 it was the first time the finalists even ran all under 10 seconds. If we look closer at the best times of Swiss athletes in each season, it seems to be clear that even if Swiss athletes run their best time in a major event, they run more slowly the 100m than all finalists, with an exception in 2017.

1.2. Women's 100 m

If we're taking a closer look at the 100m women, we can see that in the past 20 years it was necessary to run under 11 seconds to have a chance for a gold medal. Only in 2000 and 2007 a gold medal was achieved with a time over 11 seconds. Nevertheless, a certificate at World Championships or Olympic Games was possible with a time over, but close to, 11 seconds. In 2016 it was the first time the finalists even ran all under 11 seconds.

If we look closer at the best times of Swiss athletes in each season, we see a strong development. Until and with 2017 even if Swiss athletes ran their best time in a major event, they ran more slowly the 100m than all finalists. In 2018, it was the first time that the Swiss Season Best was better than the time run by the last finalist. It was not only in 2018, but all the years afterwards, that the Swiss Season Best was as good as to be in the top 8 of the world. In 2021, even the "magic barrier" of 11s was broken through by Swiss athletes, confirming the positive trend in this discipline.

2. 200 m

2.1. Men's 200 m

For the 200m Men it seems that over the last 20 years a time under 20 seconds was established to reach a gold medal at World Championships or Olympic Games. The last time a time over 20 seconds was enough for a gold medal was in 2017. In certain years (2007 - 2012 and 2022) there was a big gap of 1 second or more between the time of the gold medalists and the last finalist. This is mostly due to the results of the exceptional athlete Usain Bolt. All finalists usually run around 20.5 seconds or better. Swiss athletes come closer to the times of finalists in 200m men than in 100m men. In 2018 and 2019 Alex Wilson even ran a season best, which is better than the time of finalists in World Championships and Olympic Games.

2.2. Women's 200 m

For the times of 200m Women, we can see a big development over the past 22 years. While in 2000 a time over 22.5s was enough to win a gold medal at

Olympic Games, in 2022 the World Champion ran more than 1s faster (21.45s). So, it became normal that athletes have to run close to or under 22s to win a gold medal at major events.

All finalists at major events usually run around 23s seconds or better. The final of the Olympic Games Tokyo 2020 (reported to 2021) was the “fastest final of all times”, with all finalists running under 22.5s (22.3s and better)).

Swiss athletes didn’t have international results between 2000 and 2012. Nevertheless, from 2012 the discipline 200m Women developed strongly in Switzerland. Since 2017 the Swiss Season Best was regularly good enough to run into the top 8 of a major event.

3. 400 m

3.1. Men’s 400 m

In 400m Men, athletes have to run a time around 44 seconds to be able to achieve a gold medal at World Championships or Olympic Games. Finalists' times were between 44.6 and 46.1 seconds from 2000 - 2023. Swiss athletes haven’t run times for finalist ranks in the past. But, in 2021 and 2022 the best time of the season for Swiss athletes was as good as or better than times of finalists at World Championships or Olympic Games.

3.2. Women’s 400 m

The Women’s 400m didn’t have a strong development compared to 100m and 200m women. In 2000 and 2022 a gold medal at the Olympic Games/ World Championships was won with the same time (49.11s). It can be said, that a time around 49s is needed to be able to win a gold medal at major events and a time under 51s is normal for all finalists at Olympic Games or World Championships

In Switzerland, the first international result was registered in 2012. Until today Switzerland didn't catch up to the world best in 400m Women. Anyways, a positive development can be seen. At least a 1s improvement in Swiss Season Best time has to be made to be able to compete with the world best.

4. Long Jump

4.1. Men’s Long Jump

In Men Long Jump athletes had to jump at least 8.31m in the last 20 years to be able to win a gold medal at World Championships or Olympic Games. The results of the finalist who ended up last place in their final lie around 8m and vary between 7.85m and 8.21m. Only in the last two years (2021, 2022) Swiss athletes’ season best is higher than 8m and thus had a chance to be under the top 8 athletes in the world.

4.2. Women’s Long Jump

In Women Long Jump athletes had to jump at least 6.82m in the last 22 years to be able to win a gold medal at World Championships or Olympic Games. The results of the finalist who ended up last place in their final lie around 6.50m and vary between 6.35m and 6.82m. Only from 2009 - 2012, 2014 and 2022 Swiss athletes’ season best is higher than 6.50m. From 2016 to 2022 a

strong development of the Swiss Season Best time in 200m Women can be seen.

5. Conclusion

At the moment, Switzerland can compete with the world's best athletes in the disciplines 100m Women, 200m Women, 400m Men and Long Jump Men and is showing in general a positive trend of development in the above analysed “sprint disciplines”. With top results in all four disciplines (if we look at men and women together), it seems that there is the Know-How in Switzerland to succeed in all four “sprint disciplines”.

Nevertheless, there is still a gap between the gold medalists at Olympic Games and World Championships and the world record. The question for the future is: how can Swiss athletes close the gap to win a gold medal at major events?

Additionally, if we take a closer look at Switzerland’s best results in the application, we can see that the results are depending on individual top performers. To guarantee the success and the positive development in the future, more athletes with world class performances are needed.

DISTANCE FROM RECORDS: ANALYSIS OF SWISS ATHLETES

1. 100m

1.1. Men’s 100 m

In this discipline the most performing athletes are Alex Wilson, Pascal Mancini and Silvan Wicki. None of them could run in less than 10s. This explains the lack of medals and certificates, even though the participation in the last 20 years seems to be high.

1.2. Women’s 100 m

Differently from men’s 100 m, women seem to be more competitive in international competitions. In particular, we are interested in two athletes, Mujinga Kambundji and Ajla Del Ponte. They are the only two Swiss runners that could run under 11s. For what concerns Mujinga Kambundj, she won a bronze medal and a silver medal in the European Championship 2016 and 2022. Ajla Del Ponte won in 2019 the Universiadi, and in the major competitions reached the 5th position in 2021 in the Olympic Games.

2. 200 m

2.1. Men’s 200 m

Also in the men's 200m, we can find the athlete Alex Wilson. He could run in 20.04s. Other impressive results are from Marc Schneeberger in 2010 and William Reais. Generally, in the 200m Swiss athletes seem to be more competitive than in the 100m. Alex Wilson, achieved the bronze medal in the European Championship 2018. Moreover, William Reais won the European Championship competition Under 23 (out of our analysis, but interesting to know) in 2021.

2.2. Women’s 200 m

Similarly to the case of women 100m, the data are concentrated between 2010 and today. It is possible to notice how many values are in the Senior and

in the Junior class. Also in this discipline, the top athlete is Mujinga Kambundji, followed by Sarah Atcho and Lea Sprunger. In particular, Mujinga Kambundji won a gold medal in the last European Championship. Apart from her, only Sarah Atcho could go under 23s in the discipline.

3. 400 m

3.1. Men's 400 m

The main athletes in this discipline are Ricky Petrucciani, Lionel Spitz and Pierre Lavanchy. They are the only three athletes that could run under 46s. To be more specific, Ricky Petrucciani achieved a silver medal in the European Championship in 2022 and gold medal in the Under 23 European Championship in 2021. However, the distance from the top is still huge. In fact, the world record is exactly two seconds faster.

3.2. Women's 400 m

Women's 400 m is a category not particularly crowded. In fact, there are just a few athletes competing in Switzerland. Between them, the most gifted seems to be Lea Sprunger, the only one that could go under 52s. She won two gold medals in her career, in 400m indoor and 400m hurdles. However, she could not achieve a significant result in the 400m (our focus). Other interesting athletes are Silke Lemmens,Rachel Pellaud and Giulia Senn.

4. Long Jump

4.1. Men's Long Jump

In this discipline the most performing athlete is Simon Ehammer. This long jumper has important palmares in the discipline of decathlon. He started to participate in the long jump competition in 2021, in the Under 23 European Championship, winning the competition. His best result was in 2022 in the World Championship, where he gained the bronze medal. It is bizarre that he never participated in any Junior or Youth events. Another interesting athlete is Jarod Biya, who was very performant in Youth and Junior competition.

4.2. Women's Long Jump

In women's Long Jump the most important performers are Irene Pusterla and Anna Kälin. Both of them seem to be quite distant from the world's best results. This is typical in the discipline, where we have a lot of records but just a few athletes that can reach the top.

5. Conclusion

A more deep analysis is conducted into the file sport_data_analytics_report.Rmd in the rmarkdown folder.

As we already mentioned, our purpose is to inform and make, if possible, some suggestions. At the moment, we believe that in the disciplines women's 100m and 200m, men's 200m, 400m and Long Jump, the Swiss Federation should maintain the effort of the last 20 years. It means investing in the development of young athletes, creating better infrastructures and a better sports environment.

Actually, we can only suggest investing also in the other disciplines. However, in this case, the investment should be more effortful due to different reasons. For example in women's Long Jump we have difficulties understanding the patterns of the athlete, meaning that in the major competitions we have chunks of data aggregated in time. As a consequence, we believe that investing in the sector could end up to be either

very useful or totally useless, however it would be expensive, especially analysing how to improve it.