

Rio 2016 Olympic Performance Assessment – A European Perspective

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ABSTRACT

The medal table for the athletics events at the 2016 Olympic Games shows that for the first time ever Europe was not the strongest of the IAAF's six Area groups. As top performances have become more globalised in the last 30 years, the percentage of medals taken by Europe has decreased, especially since 2004. This trend has been reinforced by the nullification of many performances in the last decade after re-testing of stored doping control samples and retroactive suspensions. This article examines the performances of Europe's athletes in Rio set against the context of the major events of the last two Olympic cycles. It includes short evaluations of all the competitions in Rio by an experienced head coach, statistical analysis of the medal and finalist points tables and the Performance Delivery Index (PDI), which quantifies success at meeting basic objectives for a major championships. The authors suggest that Europeans responsible for high-performance results should consider all factors impacting major event success, learn from countries in other parts of the world that are taking a greater percentage of medals than in the past and use the PDI as a measure of incremental improvements.

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Introduction

At the 2016 Olympic Games in Rio de Janeiro, Brazil, a total of 2,283 athletes from 199 IAAF Member Federations took part in the athletics competitions. The globalisation of top performances at the world's major athletics championships was demonstrated by the fact that 42 countries had medallists in Rio, second only to the 43 at the 2015 IAAF World Championships in Athletics in Beijing, and 69 countries had finalists (top 8), second only to the 70 at the 2012 Olympics in London.

Athletes from 18 European countries took a total of 36 medals (11 gold, 10 silver, 15 bronze), which is 25.5% of the 141 awarded. This is the continent's lowest percentage ever

at the Olympics or IAAF World Championships and a continuation of a trend of decline against the rest of the world that started after a 1987 high point and has become more pronounced since 2004. In fact, Rio was the first time ever that Europe was not the strongest of the six Area groups into which the IAAF's Member Federations are divided. Led by the exceptional 32-medal performance of the USA, the NA-CAC group (North America, Central America and Caribbean) was the top performing Area with 54 medals (21 gold, 16 silver, 8 bronze) or 38.3% of the total.

An assessment of this declining trend must take into account the reassignment of many medals resulting from retroactive suspensions after re-testing of stored doping control samples. As of July 2017, 344 suspensions affecting 37 countries (14 European) could be identified. A number of these have meant that major event performances have been nullified and medals have been reassigned or in, some cases, simply not awarded. For example, at the time this article was written, the International Olympic Committee listed a total of eight med-

als from the 2012 Olympics as vacant. The nullified performances have impacted Europe's medal and finalist numbers at the major events in the last decade. Figure 1 shows the trend of the percentage of medals taken by Europe and the rest of the world since 1987 adjusted with the latest information available.

This article examines the performances of Europe's athletes at the Olympic Games in Rio set against the context of the major events of the last two Olympic cycles, starting with the 2008 Games in Beijing. The aim is to provide basic data and contribute to discussions by national performance directors, head coaches and athlete support teams on ways to assess results in an effort to maximise them in the future. It follows similar assessments of European performances published in these pages¹. With such debriefings, and the comparisons with the rest of the world that they contain, coaches and others responsible for the preparation of high-performance athletes can evaluate the programmes and means they currently employ to see if adjustments are required in order to produce more success at future major events.

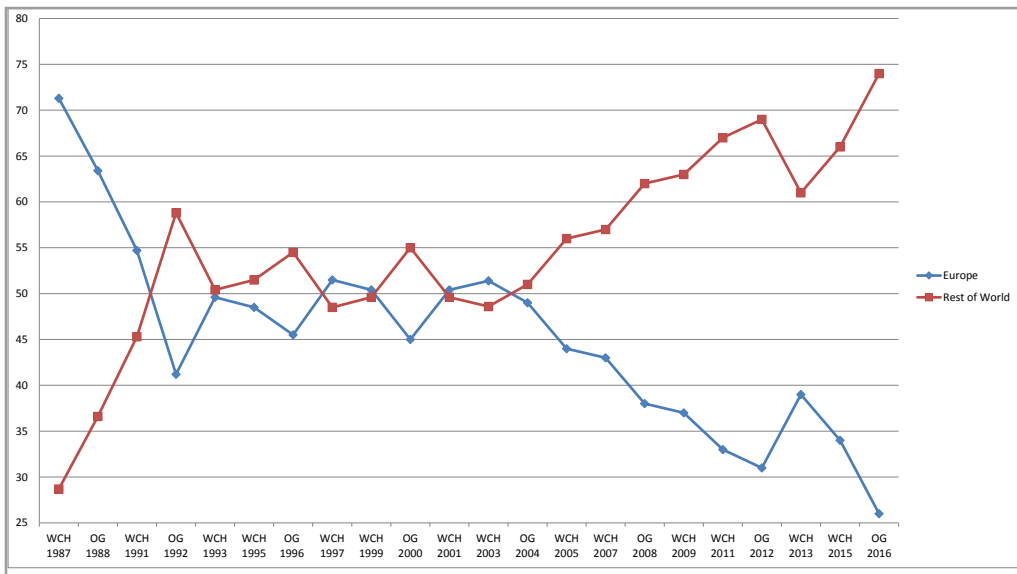


Figure 1: Percentage of major championship medals for Europe and the rest of the world at global athletics championships 1987 to 2016

Technical Evaluations

Women's Sprint Events

100m: Among the greatest finals ever: the 10.86 average for the top seven compares to 10.88 in London 2012, 10.95 in Moscow 2013 and 10.90 in Beijing 2015. A clear win for Thompson (JAM), whose 10.71 would have taken all those races (=1st in Moscow 2015). Schippers (NED) in fifth was Europe's only finalist and none of the other seven semi-finalists (out of 24) beat 11.08.

Event Quality: 10
European Performance: 6

200m: Surprising Thompson (JAM) doubled back to beat European Champion Schippers (NED), both with SBs: 21.78 vs 21.88 (the only two under 22.00), reversing the Beijing 2015 result. Note that Ta Lou (CIV) was fourth in 100m and 200m, both with NRs. Three European finalists were backed up with five more semi-finalists (out of 24) who had an average age of 22.6 years.

Event Quality: 9
European Performance: 8

400m: Miller (BAH) surprised Felix (USA) in the last metres to reverse the Beijing 2015 result in a slightly lower quality final (50.37 average for top-8 vs 50.13 in Beijing). Europe's two finalists were seventh and eighth and none of the seven other semi-finalists (out of 24) looked close to making the final.

Event Quality: 7
European Performance: 7

4x100m: A very strong race: USA's winning 41.01 was the second best all-time, the top-3 average of 41.38 was possibly the best-ever and six teams were under 42.40, which usually gets a medal. GBR, with a 41.77 NR, took the bronze medal and led three European teams in the final.

Event Quality: 9
European Performance: 7.5

4x400m: One of the weakest finals of the Games was easily won by the USA with 3:10.06 ahead of JAM's 3:20.34. GBR's bronze medal time of 3:25.88 would have only got sixth in Beijing 2015. Europe had only two finalists.

Event Quality: 6
European Performance: 7

Women's Endurance Events

800m: A strong race won by Semenya (RSA) with an excellent NR of 1:55:28 and all finalists below 2:00. Europe did well to take fifth through seventh with two PBs and it had a total of 12 (out of 24) in the semis, four of which missed the final by .40 or less.

Event Quality: 9
European Performance: 9

1500m: Tactical race won by the young Kipyegon (KEN) ahead of WR holder Dibaba (ETH). Europe was well represented with five finalists, 5-6-7 and 10-11.

Event Quality: 6
European Performance: 8

5000m: Questionable tactics by Ayana (ETH) opened the door for 32 year-old Cheruiyot (KEN), who set an OR and led a KEN 1-2-4. Europe took sixth through eighth, but all three were half a minute behind the winner. The PB for Grøvdal (NOR) came after a PB in the 10,000m.

Event Quality: 8
European Performance: 7

10,000m: Best race ever was dominated by Ayana (ETH) with terrific 29.17.45 WR, but the 37 participants also set five NRs, 17 PBs and five SBs. Only one European in the top-8, but six more in top-17 with four PBs.

Event Quality: 10
European Performance: 6

3000m Steeplechase: A good race after a long period of stagnation at the top level. Won by Jebet (BRN) with 8.59.75 AR beating Jepkemboi (KEN) and Coburn (USA), who also set a new AR. Only one European, Krause (GER) was in top-8, but there were three PBs and four SBs in the heats.

Event Quality: 9
European Performance: 6

Marathon: Medium quality results affected by the hot weather with Jelagat (KEN) winning in 2.24.04. Absolute record participation with 156, 23 DNFs. Mazuronak (BLR) was competitive but Europe's next best was more than five minutes off the pace in 12th.

Event Quality: 7
European Performance: 3

20km Race Walk: Dominated by the Chinese team with three in the first five. Even without the Russians, Europe had a fairly good day: led by Palmisano (ITA) there were eight from six countries in the top-16 finishers.

Event Quality: 8
European Performance: 7

Women's Hurdles Events

100m: Led by 2013 World champion Rollins, the USA swept the podium places despite the absence of WR holder Harrison, who did not qualify for the team. The average time for the finalists was 12.682 compared to 12.596 in London 2012. Europe had three (and the only SB) in the final to get 4-5-7, plus 10 more in the semis (out of 24).

Event Quality: 8
European Performance: 8

400m: One of the best races of 2016 for this event was won by the most consistent athlete, Muhammad (USA), in 53.13 ahead of four PBs and one SB. But with just four under 54 sec and the average for the finalists at 54.01 (same as for London 2012) the event remains somewhat stagnant. The 53.55 NR by European Champion Petersen (DEN) in second led three Europeans in the final and nine more (out of 24) in the semis.

Event Quality: 7
European Performance: 8

Women's Jumping Events

High Jump: The weakest global championship competition in this event since 1980: the winning height of 1.97m only got seventh at the 2015 WCH in Beijing and was less than the top mark in the heptathlon here. Led by the 36-year-old Beitia (ESP), Europe did well to sweep the medals and have 11 out of the 17 that contested the final.

Event Quality: 5
European Performance: 10

Pole Vault: Stefanidi (GRE) performed well with 4.85m, very close to her PB, to win on misses over the favourite Morris (USA). Overall performances were not particularly strong. Interesting result for 20 year-old McCartney (NZL): bronze medal with NR of 4.80m. In addition to its gold, Europe was well represented with six out of the 12 contesting the final.

Event Quality: 6
European Performance: 9

Long Jump: The best competition of the last decade: three over 7m and a top-8 average of 6.92m (compared to 6.86m in London 2012). Bartoletta (USA) merited the victory over defending Olympic champion Reese (USA) because she had the best average in the final. European champion Spanovic (SRB) was third with her 7.08m NR and there were seven other Europeans in the final 12.

Event Quality: 10
European Performance: 8

Triple Jump: Ibarguen (COL) dominated as usual, winning with 15.17m. The top-8 average of 14.71m (compared to 14.58m at London 2012, 14.52m at Moscow 2013 and 14.57m at Beijing 2015) indicates the event is picking up a little. Best of the seven Europeans in the finals was Beijing 2015 silver medallist Knyazyeva-Mineko (ISR) in fifth.

Event Quality: 8
European Performance: 6.5

Women's Throwing Events

Shot Put: A good head to head competition won by Carter (USA) with a new NR of 20.63m over Adams (NZL), who did well to throw twice over 20m after a serious injury. Marton (HUN) took the bronze with an impressive 19.87m NR to lead three other Europeans in the final, but defending champion Schwanitz disappointed with a best throw more than a metre down on her SB.

Event Quality: 7
European Performance: 8.5

Discus Throw: First and second for Europe. One valid throw of 69.21m was enough for Perkovic (CRO) to win while Beijing 2015 silver medallist, 37 year-old Robert-Michon (FRA), impressed with a 66.73m NR for silver in her fifth OG. The top-8 average of 64.98m was down on the 65.85m at London 2012.

Event Quality: 7
European Performance: 10

Hammer Throw: Top quality. Led by the 82.29m WR of "Queen" Wlodarczyk (POL), the top-8 were all beyond 70m. Europe also got the bronze with an impressive last throw 74.54m NR by Hitchon (GBR), which moved her past Heidler (GER) and Pertivskaya (MDA) in fourth and fifth. Europe's dominance was confirmed with a total of seven of the 12 competing in the final.

Event Quality: 10
European Performance: 10

Javelin Throw: The 21 year-old Kolak (CRO) threw 66.18m (her fifth NR of the year) to beat Viljoen (RSA) and double defending champion/WR holder Spotakova (CZE). Weakest final in recent years: the medallists averaged 65.30m (compared to 67.20m in Beijing 2015, 66.72m in Moscow 2013 and 66.54m in London 2012). Europe's medals were backed up with a fourth and fifth plus four more in the final competition.

Event Quality: 6
European Performance: 9

Women's Combined Events

Heptathlon: A very good event for Europe: gold and silver plus 13 of the top-20. The 6,810 points NR by Thiam (BEL) beat London 2012 champion Ennis-Hill (GBR). Overall the level was strong at the top (the average for the medallists was 6,746 compared to 6,734 in London 2012) and strong in depth (13 over 6,300 compared to 14 in London 2012).

Event Quality: 9
European Performance: 9.5

Women's Events - Overall Evaluation

The average strength of the women's events in Rio was a strong 7.87 and the global trend can be considered positive, but certain events (e.g. pole vault, high jump, triple jump, 400m hurdles and 3000m steeplechase) are in some degree of stagnation. Despite the absence of the Russians, Europe's athletes performed well overall with an average rating of 7.82 - dominating the throws, partially the jumps and the heptathlon - but there is clear weakness at the top (medals and finalists) in most of the running and hurdle events.

Men's Sprint Events

100m: Bolt (JAM) again. Despite one NR, one PB and two SBs, it was, relatively speaking, medium quality for a global competition: the top-8 average of 9.942 was mostly down on previous years (Beijing 2015: 9.921, Moscow 2013 (rainstorm): 9.976, London 2012: 9.824). Europe had just one finalist (7th) and four others in the semis (out of 24).

Event Quality: 8

European Performance: 5

200m: Bolt dominated: the only finalist under 20 sec, and the only SB. Top-8 average: 20.127. Good event for Europe with three fighting hard for bronze, one other finalist and nine in the semis (out of 24). With Merritt (USA) and Martina (NED) both over 30, the average age for the finalists is up to 27 from 24.6 in London 2012, but new-comer De Grase (CAN), who took silver, is just 22.

Event Quality: 7

European Performance: 8

400m: The best 400m race ever? Van Nierek (RSA) 43.03 WR, two more NRs, one PB, two SBs and a top-8 average of 44.04. This is an event to watch in the future as the average age of the finalists was just 23. Europe was not really a factor: only one finalist (8th) and none of the other four in the semis looked close to making it through despite three SBs.

Event Quality: 10

European Performance: 4.5

4x100m: A JAM victory but their 37.27 was the slowest winning time of the last three OG finals. A very good run for JPN in second (after 3rd in Beijing 2008 and 4th in London 2012); the DQ of USA gave CAN the bronze. Europe had only one finalist: GBR in fifth.

Event Quality: 7

European Performance: 5

4x400: Easy win for USA in good race with six teams below 3:00 (4 in London 2012 and 4 in Beijing 2008). Best European performance was BEL (three of the four are brothers!!) with an NR in fourth only .03 off a medal, but, in line with its weakness in the 400m, Europe had only one other finalist (POL in 7th). GBR might have been a factor but was DQed after an impressive run in the heats.

Event Quality: 9

European Performance: 6

Men's Endurance Events

800m: Not quite like London, but still a very good race won by the best ever, Rudisha (KEN), in 1:42.15 ahead of one NR, one PB and three SBs. Average age of the finalists: 25 years. The 24 year-old Bosse (FRA) ran a brave race in fourth; he and Lewandowski (POL), the only other European in the final, both ran SBs (also in the semis). Six other Europeans in the semi-finals (out of 24).

Event Quality: 9

European Performance: 7

1500m: Tactics were all as indoor World champ Centrowitz (USA) led the whole way slowly (second lap 69.76!) then kicked big (last 400m in 50.62) to win in the slowest OG time since 1932. Finalists' average age was 27 (Centrowitz: 24). Note: Makhloufi (ALG) got silver in 1500m and 800m. Europe had two in the final (7th and 12th) and seven more in the semis (out of 26) but none looked like a factor.

Event Quality: 5
European Performance: 4

5000m: A second win on the track for Europe with Farah (GBR) holding off Chelimo (USA) and Gebrhiwet (ETH) in a credible 13:03.30 (after 13:41 in London 2012, 13:26 in Moscow 2013 and 13:50 in Beijing 2015). The other European in the final, Butchart (GBR) in a good seventh, was the first non African-born finisher. Four other Europeans made the top-30 in the heats.

Event Quality: 8
European Performance: 6.5

10,000m: Farah (GBR) cemented his position as the greatest racer in this event and won a second gold on the track for Europe with a terrific last lap fighting until the end with Tanui (KEN). Globally a very good race with one NR, three PBs and seven SBs. Only four other Europeans finished (13-20-25-31).

Event Quality: 9
European Performance: 6

3000m St.: Interesting fight between Kipruto (KEN) and Jager (USA), both topping the OR. Europe took bronze with Mekissi (FRA) and also had Kowal (FRA) in fifth. Not much joy in the heats as only one of the other 12 Europeans to finish could get under 8:30.

Event Quality: 7
European Performance: 6

Marathon: Former World 5000 champ Kipchoge (KEN) won with 2:08:44, more 1:00 ahead of second, after a slow first half. Average age of the first eight: 27.4 years. Record participation: 155 (140 finished). Europe had nine in the top 30; its first three finishers (7-9-11) between 2:11:42 and 2:13:01 and two of these under 28 years old offered some hope for the future.

Event Quality: 8
European Performance: 5

20km Race Walk: A good race dominated by the Chinese athletes Wang and Cai ahead of two NRs, three PBs and one SB in the first ten places. Six athletes were DQed. Europe had a down year with just four in the top 12 (5-6-8-11).

Event Quality: 7
European Performance: 6

50km Race Walk: Toth (SVK) and Tallent (AUS) repeated the Beijing 2015 result in close to the same times with Arai (JPN) moving up from fourth to third. From 81 starters there were 12 DQs and 19 DNFs. In addition to the winner, Europe had three in the top 8 (6-7-8).

Event Quality: 6
European Performance: 8

Men's Hurdles Events

110m: McLeod (JAM) upset Ortega (ESP), Bascou (FRA) and Martinot-Lagarde (FRA) in a slightly slow 13.05 (winner in Beijing 2015: 12.98, Moscow 2013: 13.00, London 2012: 12.92) even if the finalists' average of 13.26 was in the normal range. A young final: average age 22.5 years. A good event for Europe with silver and bronze, two more in the final and eight more in the semis (out of 24).

Event Quality: 8
European Performance: 9

400m: At 30 years-old Clement (USA) won OG gold ahead of three others who broke 48.00. The final featured countries not normally associated with this event (KEN, TUR, IRL, EST), four NRs and three athletes under 25 years old, indicating that a long-term stagnation may be coming to an end. Europe did well with 3-4-6 and five more in the semis (out of 24).

Event Quality: 7

European Performance: 8

Men's Jumping Events

High Jump: Consistent in top-level competitions over the last four years, Drouin (CAN) won with 2.38m over the favoured Barshim (QAT), 2.36m, and Bondarenko (UKR), 2.33m. Europe had a good performance with two more at 2.33m and a total of seven out of the 15 contesting the final (two from CYP!).

Event Quality: 9

European Performance: 8

Pole Vault: Da Silva (BRA) won with 6.03m OR after skipping the Diamond League circuit on advice of his coach. Favourite and WR holder Lavillenie (FRA) went for broke to try 6.08m after two misses at 6.03m and ended up with silver. Europe also had two at =fourth and three more in the final competition of 12.

Event Quality: 9

European Performance: 9

Long Jump: Henderson (USA) and Manyonga (RSA) jumped well to best Olympic and World champion Rutherford (GBR) and get close to 8.40m. The top eight were all over 8m and averaged a healthy 8.21m (Beijing 2015: 8.13m, Moscow 2013: 8.24m, London 2012: 8.10m). Europe only had two in the final and two others that were within 10cm of qualifying from the prelims.

Event Quality: 7

European Performance: 6

Triple Jump: Cut and paste of London 2012: Taylor (USA) and Claye (USA) took gold and silver. Top-8 average of 17.25m was down from the 17.37m at Beijing 2015. Interesting progress for the Chinese Dong and Cao in third and fourth: neither made the final in Beijing 2015. Europe's three in the final were 6-10-12 and only two others were within 10cm of qualifying from the prelims.

Event Quality: 7

European Performance: 5

Men's Throwing Events

Shot put: New blood at the top: the winner, Crouser (USA), 24 years old, set new OR of 22.52m and the average age of the first five was 25. Interesting to see Elemba (CGO) in fourth and Romani (BRA) in fifth. Normally a strong event for Europe, but this year the four in the final (6-7-11 and NM) were all off their bests.

Event Quality: 9

European Performance: 5

Discus Throw: Taking the first 10 places, this was a great event for Europe. The winner was "another" Harting (GER) with a PB on his last attempt. The best series (3 over 67m) was by 33 year-old Malachowski (POL) in second. The overall quality of marks was in line with recent championships: top-8 average was 65.99m (Beijing 2015: 65.21m, Moscow 2013: 65.47m, London 2012: 66.90m).

Event Quality: 8

European Performance: 10

Hammer Throw: Nothing new on the podium: Nazarov (TJK), 40 year-old Tsikhan (BLR) and Nowicki (POL). The top-8 average of 76.44m was slightly down on recent championships (Beijing 2015: 77.75m, Moscow 2013: 79.04m, London 2012: 77.77m). In addition to two medals, Europe had three more in the top eight and eight out of the 12 in the final competition.

Event Quality: 7

European Performance: 9

Javelin Throw: Rohler (GER) with 90.30m beat Yego (KEN) and London 2012 champ Walcott (TTO). The winning mark and number over 85m, six, were slightly down from Beijing 2015 but the overall quality was still good. In addition to gold Europe had 4-5-6-7-8-9 Note: the Finns had only one finalist, 32 year-old Ruuskanen, in fifth.

Event Quality: 8

European Performance: 9

Men's Combined Events

Decathlon: Defending champ and WR holder Eaton (USA) scored 8,893, the seventh best mark ever, to tie the OR of Sebrle (CZE) and beat a field of unprecedented quality: top-8 average 8,585 and 11 over 8,300. Europe did well with the silver of Mayer (FRA), Kazmirek (GER) in fourth and Van der Plaetsen (BEL) in eighth.

Event Quality: 9

European Performance: 8

Men's Events - Overall Evaluation

Generally speaking men's performances were satisfactory with only two events rated less than 7 and the 7.83 average just slightly lower than the women. Nevertheless, some events, especially 400 hurdles and endurance races, are in stagnation. Although Europe's men had the same number of medals as the women, they had more weak events (below 6) and an overall average of 6.77. Their strongest event group was the long throws and their weakest was almost anything on the track.

Medals

Table 1 shows the distribution of the medals in Rio. The highlight has to be the 32 medals (13 gold, 10 silver, 9 bronze) taken by the USA, which was followed by Kenya with 13 and Jamaica with 11. Of note is the wide spread of where the medals went: a total of 42 countries took medals. Even if there was a slight step backwards from the year before at the IAAF World Championships in Athletics, the increasing spread of success since 29 countries took medals at the World Championships back in 1987 is firmly established.

Also of note is that collectively the USA, Kenya and Jamaica took 56 medals. These three countries have been consistently close to that level over the last decade and for some time before that. Compared to the collective 27 medals they took in 1987 and it is clear that the success of these three has had a significant impact on the erosion of Europe's domination.

Europe's top teams in Rio were Great Britain and Northern Ireland with seven medals in sixth place, France with six medals and three teams with three medals each: Croatia, Germany and Poland¹. As already mentioned, Europe's 25.5% share was its lowest ever at a major world event. The absence of the Russian team, suspended by the IAAF for serious issues in its anti-doping arrangements, no doubt had an impact. As can be seen in Table 3, even with its various retro-active suspensions and disqualifications, Russia can normally be counted on to achieve 10 or more podium places. In the absence of the Russians, Europe's medals went to 18 countries, again the second highest after 20 the previous year in Beijing, and they were evenly split between men and women (18 each).

Europe's strongest set of events was the long throws, where both the men and women took six of the nine available medals. Europe also did particularly well in the women's high jump, where it took all three medals. It is notable that

Table 1: 2016 Olympic Games athletics medals standings

Rank	Country		Gold	Silver	Bronze	Total
1	United States	USA	13	10	9	32
2	Kenya	KEN	6	6	1	13
3	Jamaica	JAM	6	3	2	11
4	PR of China	CHN	2	2	2	6
5	South Africa	RSA	2	2	–	4
6	Great Britain & Northern Ireland	GBR	2	–	4	7
7=	Croatia	CRO	2	–	1	3
7=	Germany	GER	2	–	1	3
9	Ethiopia	ETH	1	2	5	8
10	Canada	CAN	1	1	4	6
11	Poland	POL	1	1	1	3
12=	Bahrain	BRN	1	1	–	2
12=	Spain	ESP	1	1	–	2
14	Bahamas	BAH	1	–	1	2
15=	Belgium	BEL	1	–	–	1
15=	Brazil	SWE	1	–	–	1
15=	Colombia	COL	1	–	–	1
15=	Greece	GRE	1	–	–	1
15=	Slovak Republic	SVK	1	–	–	1
15=	Tajikistan	TJK	1	–	–	1
21	France	FRA	–	3	3	6
22	Algeria	ALG	–	2	1	2
23	New Zealand	NZL	–	2	1	4
24=	Australia	AUS	–	1	–	2
24=	Japan	JAP	–	1	–	2
26=	Burundi	BUR	–	1	–	1
26=	Belarus	BLR	–	1	–	1
26=	Bulgaria	BUL	–	1	–	1
26=	Denmark	DEN	–	1	–	1
26=	Genada	GRN	–	1	–	1
26=	Mexico	MEX	–	1	–	1
26=	Netherlands	NED	–	1	–	1
26=	Qatar	QAT	–	1	–	1
26=	Venezuela	VEN	–	1	–	1
35=	Cuba	CUB	–	–	1	1
35=	Czech Republic	CZE	–	–	1	1
35=	Hungary	HUN	–	–	1	1
35=	Kazakhstan	KAZ	–	–	1	1
35=	Serbia	SRB	–	–	1	1
35=	Trinidad and Tobago	TTO	–	1	–	1
35=	Turkey	TUR	–	–	1	1
35=	Ukraine	UKR	–	–	1	1
Total			47	47	47	141

Table 2: 2016 European medals at major championships 2008-2016 (OG = Olympic Games, WCH = IAAF World Championships in Athletics)

		Events	Medals	of Total
2008	Beijing (OG)	47	41	31.7%
2009	Berlin (WCH)	47	53	37.3%
2011	Daegu (WCH)	47	45	31.9%
2012	London (OG)	47	40	30.0%
2013	Moscow (WCH)	47	54	38.0%
2015	Beijing (WCH)	47	49	34.0%
2016	Rio de Janeiro (OG)	47	36	25.5%

Europe could take only one out of nine available medals in its traditional stronghold, the race walking events.

It should be pointed out that the adjustments made for retroactive disqualifications have affected Europe's medal totals and percentages at each major event over the last decade, with the continent losing medals to the rest of the world in each case (See Table 2). These changes have strengthened the previously reported negative trend. In the updated Figure 1 and we can see that after 2005 Europe was no longer

on a par with the rest of the world combined, even if it was still the strongest of the six Area groups until 2016.

Table 3 shows how the medal totals of the top 10 teams on the Rio medal table plus selected European teams have progressed in the last decade. We can see that in 2016 France bounced back strongly from a down year in 2015 but the other top European teams covered had results that were mostly consistent with previous years (GBR, CRO, ESP, UKR, ITA) or were significantly below the previous year's performance (GER, POL).

Table 3: Medal totals at major championships 2008-2016 for the top teams at the 2016 Olympic Games (OG = Olympic Games, WCH = IAAF World Championships in Athletics)

2016		2008 Beijing OG	2009 Berlin WCH	2011 Daegu WCH	2012 London OG	2013 Moscow WCH	2015 Beijing WCH	2016 Rio de Janeiro OG
Rank								
1	USA	25	22	28	28	26	18	32
2	KEN	14	11	18	13	12	16	13
3	JAM	11	13	9	12	10	12	11
4	CHN	3	4	6	9	4	9	6
5	RSA	3	3	4	1	1	3	4
6	GBR	6	7	8	6	6	7	7
7	CRO	1	1	1	1	1	2	3
8	GER	1	9	7	8	7	8	3
9	ETH	7	8	5	8	10	8	8
10	CAN	2	1	1	1	5	8	6
11	POL	2	9	2	2	3	8	3
12=	ESP	0	1	1	0	2	1	2
21	FRA	2	3	4	3	5	2	6
35=	CZE	1	1	1	3	3	1	1
35=	UKR	4	0	2	3	3	2	1
	ITA	2	1	2	1	1	0	0
	RUS	14	11	10	10	14	4	DNC

Table 4: 2016 Olympic Games athletics points standings

Rank		1st		2nd		3rd		4th		5th		6th		7th		8th		Total Points
		pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	
1	USA	13	104	10	70	9	54	5	25	5	20	6	18	6	12	7	7	310
2	KEN	6	48	6	42	1	6	3	15	2	8	2	6	3	6	0	0	131
3	JAM	6	48	3	21	2	12	1	5	2	8	2	6	2	4	2	2	106
4	GBR	2	16	1	7	4	24	3	15	3	12	4	12	2	4	3	3	93
5	CHN	2	16	2	14	2	12	3	15	4	16	1	3	2	4	1	1	81
6	GER	2	16	0	0	1	6	5	25	3	12	3	9	2	4	1	1	73
7	ETH	1	8	2	14	5	30	2	10	2	8	0	0	0	0	2	2	72
8	CAN	1	8	1	7	4	24	4	20	0	0	1	3	1	2	1	1	65
9	FRA	0	0	3	21	3	18	2	10	1	4	0	0	1	2	2	2	57
10	POL	1	8	1	7	1	6	2	10	1	4	2	6	2	4	0	0	45
11	RSA	2	16	2	14	0	0	0	0	1	4	0	0	0	0	0	0	34
12	AUS	0	0	1	7	1	6	2	10	0	0	1	3	3	6	1	1	33
13	NZL	0	0	1	7	3	18	0	0	0	0	0	0	0	0	0	0	25
14	UKR	0	0	0	0	1	6	1	5	2	8	1	3	1	2	0	0	24
15=	BRA	1	8	0	0	0	0	1	5	1	4	1	3	1	2	1	1	23
15=	TTO	0	0	0	0	1	6	1	5	1	4	2	6	1	2	0	0	23
17	CRO	2	16	0	0	1	6	0	0	0	0	0	0	0	0	0	0	22
18=	BAH	1	8	1	7	0	0	0	0	0	0	1	3	1	2	1	1	21
18=	CZE	0	0	0	0	1	6	2	10	0	0	0	0	2	4	1	1	21
20=	BLR	0	0	1	7	0	0	0	0	2	8	0	0	2	4	1	1	20
20=	NED	0	0	1	7	0	0	0	0	3	12	0	0	0	0	1	1	20
22	BAH	1	8	0	0	1	6	0	0	0	0	1	3	1	2	0	0	19
23=	ALG	0	0	2	14	0	0	0	0	1	4	0	0	0	0	0	0	18
23=	ESP	1	8	1	7	0	0	0	0	0	0	0	0	1	2	1	1	18
25=	CUB	0	0	0	0	1	6	0	0	0	0	2	6	2	4	1	1	17
25=	JAP	0	0	1	7	1	6	0	0	0	0	0	0	2	4	0	0	17
27	EST	0	0	0	0	0	0	1	5	1	4	2	6	0	0	0	0	15
28=	BEL	1	8	0	0	0	0	1	5	0	0	0	0	0	0	1	1	14
28=	ITA	0	0	0	0	0	0	1	5	1	4	1	3	0	0	2	2	14
30	CIV	0	0	0	0	0	0	2	10	0	0	1	3	0	0	0	0	13
31=	COL	1	8	0	0	0	0	0	0	1	4	0	0	0	0	0	0	12
31=	MEX	0	0	1	7	0	0	1	5	0	0	0	0	0	0	0	0	12
31=	SVK	1	8	0	0	0	0	0	0	1	4	0	0	0	0	0	0	12
31=	TUR	0	0	0	0	1	6	0	0	0	0	1	3	1	2	1	1	12

Rank		1st		2nd		3rd		4th		5th		6th		7th		8th		Total
		pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	pl	pts	Points
35=	GRE	1	8	0	0	0	0	0	0	0	0	0	0	1	2	1	1	11
35=	HUN	0	0	0	0	1	6	0	0	0	0	0	0	2	4	1	1	11
37	QAT	0	0	1	7	0	0	0	0	0	0	1	3	0	0	0	0	10
38=	GRN	0	0	1	7	0	0	0	0	0	0	0	0	1	2	0	0	9
38=	MOR	0	0	0	0	0	0	1	5	1	4	0	0	0	0	0	0	9
38=	POR	0	0	0	0	0	0	0	0	0	0	3	9	0	0	0	0	9
41=	BOT	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0	0	8
41=	BUL	0	0	1	7	0	0	0	0	0	0	0	0	0	0	1	1	8
41=	IRL	0	0	0	0	0	0	1	5	0	0	1	3	0	0	0	0	8
41=	TJK	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
45=	BUR	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	7
45=	DEN	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	7
45=	VEN	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	7
48=	ERI	0	0	0	0	0	0	1	5	0	0	0	0	0	0	1	1	6
48=	KAZ	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	6
48=	SRB	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	6
51=	CGO	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	5
51=	CYP	0	0	0	0	0	0	0	0	0	0	0	0	2	4	1	1	5
51=	DJI	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	5
51=	LAT	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	5
51=	NGR	0	0	0	0	0	0	0	0	1	4	0	0	0	0	1	1	5
51=	SUI	0	0	0	0	0	0	0	0	0	0	1	3	1	2	0	0	5
51=	SWE	0	0	0	0	0	0	0	0	0	0	1	3	1	2	0	0	5
51=	UGA	0	0	0	0	0	0	0	0	0	0	1	3	0	0	2	2	5
59=	FIN	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	1	4
59=	ISR	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	4
59=	MDA	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	4
59=	NOR	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	4
59=	TAN	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	4
64=	AUT	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	3
64=	LCA	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	3
64=	URU	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	3
67=	GUY	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2
67=	PAN	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2
67=	SYR	0	0	0	0	0		0	0	0	0	0	0	1	2	0	0	2

Finalists

A deeper picture of national performance can be gained from an analysis of the finalists (top 8) using the traditional point scale (8 for first, 7 for second, etc.). Table 4 shows that 69 countries had one or more athletes/relay teams placed in the top eight, a total second only to the 70 at the 2012 Olympic Games. The big story again was the USA, which reached the highest ever score of 310 points. Mirroring the standings on the medal table, it was followed by Kenya with 131 and Jamaica with 106.

Twenty-nine European teams scored a combined total of 559 points, which was 33.14% of the overall total. This was the continent's lowest score and percentage of points ever (Table 5). Four European teams were in the top 10, led by Great Britain and Northern Ireland with 93 points in fourth, Germany with 73 points in sixth, France with 57 points in ninth and Poland with 45 points in 10th. The 29 scoring teams was down on the 33 that scored in 2015 at the IAAF World Championships in Athletics in Beijing but up from the 26 that scored in Moscow in 2013.

Table 6 shows the point trend since 2008 for the top 10 teams on the Rio points table plus selected European teams. The data reflects adjustments made following the previously mentioned performance nullifications.

The majority of the European teams covered showed improvement in 2016 over the previous year's score in Beijing but two (GER, UKR) were significantly down on their average performances in the 2008-2016 period. Again, the big difference for Europe's overall score in 2016 was the missing Russian team, which averaged more than 120 points in the previous six events.

Performance Delivery

A third and deeper measure of performance at a major event is of how well athletes deliver against key objectives for their participation, regardless of whether they take a medal or reach the finals. In each major event appearance on the track, road or field the demand on the athlete is that he/she meets a basic expectation that determines success.

We have analysed all appearances by all members of the top 10 teams (by points) at the Games in Rio plus selected European teams against the following performance objectives:

- advance to the next round of the competition;
- take a medal in the final;
- where the first two objectives are not possible, the athlete can still be said to have performed if he/she achieves a season's best.

Table 5: 2016 Comparison of finalist points for Europe and the rest of the world at major championships 2008-2016 (OG = Olympic Games, WCH = IAAF World Championships in Athletics)

	Total Points	Europe	%	Rest of World	%
Beijing (OG)	1669	711	42.60	958	57.40
Berlin (WCH)	1702	707	41.54	995	58.46
Daegu (WCH)	1673	633	37.84	1040	62.16
Lodon (OG)	1679	609	36.27	1070	63.73
Moscow (WCH)	1645	682	41.46	963	58.54
Beijing (WCH)	1695	654	38.58	1041	61.42
Rio (OG)	1687	559	33.14	1128	66.86

Table 6: Finalist points at major championships 2008-2016 for the top teams at the 2016 Olympic Games (OG = Olympic Games, WCH = IAAF World Championships in Athletics)

2016		2008 Beijing OG	2009 Berlin WCH	2011 Daegu WCH	2012 London OG	2013 Moscow WCH	2015 Beijing WCH	2016 Rio de Janeiro OG
Rank								
1	USA	214	232	261	301	282	214	310
2	KEN	138	123	181	117	139	138	131
3	JAM	126	136	105	110	100	132	106
4	GBR	75	83	73	94	79	94	93
5	CHN	44	52	67	86	42	94	81
6	GER	55	108	88	103	102	113	73
7	ETH	77	89	68	95	97	83	72
8	CAN	24	12	13	26	41	66	65
9	FRA	41	42	47	49	50	43	57
10	POL	46	74	46	28	44	68	45
14	UKR	45	29	32	33	47	30	24
17	CRO	7	10	7	8	8	14	22
18=	CZE	23	14	26	18	0	14	21
23=	ESP	36	23	12	13	24	12	18
28=	ITA	23	25	22	18	18	11	14
	RUS	156	118	124	95	183	60	DNC

The interesting thing about the Olympic Games or IAAF World Championships in Athletics is that they are unquestionably the high point of the season; they are the day to deliver. Although there is certainly an element of improving the level of the athlete involved, just as important for the high-performance system is to ensure that he/she is fully prepared to deliver on the day at such a top event. The regularity with which a country's athletes succeed at this task is an indicator of how effective coaches and support personnel are at preparing their athletes to perform. Analysis gives us a percentage of the appearances where the athletes delivered the defined performance objective, or a Performance Delivery Index (PDI)³,

which can be seen in Table 7. This PDI can be monitored from year to year to assess the development of the high-performance support system

Of the teams studied, the top three in the medal and points tables in Rio also had very high PDI scores: Jamaica 64.71 (men 61.70 / women 67.27), Kenya 64.20 and USA 64.19. The top European team for PDI was Croatia with 60.00 (men 25.00 / women 72.73) followed by Great Britain and Northern Ireland and France, both with overall scores of 56.67. Interestingly, top point scoring European teams Germany, Poland and Ukraine did not reach overall PDI scores of 50.

Table 7: Performance delivery data for top teams at the 2016 Olympic Games

2016 Rank			Athlete Appearances	Advance or Medal	Seasons Bests	Total Successes	PDI
1	USA	Men:	110	67	5	72	65.45
		Women:	119	71	4	75	63.03
		Team Total:	229	138	9	147	64.19
2	KEN	Men:	48	27	2	29	60.42
		Women:	33	21	2	23	69.70
		Team Total:	81	48	4	52	64.20
3	JAM	Men:	47	29	0	29	61.70
		Women:	55	37	0	37	67.27
		Team Total:	102	66	0	66	64.71
4	GBR	Men:	57	27	2	29	50.88
		Women:	63	36	3	39	61.90
		Team Total:	120	63	5	68	56.67
5	CHN	Men:	34	14	0	14	41.18
		Women:	34	12	0	12	35.29
		Team Total:	68	26	0	26	38.24
6	GER	Men:	48	11	3	14	29.17
		Women:	72	28	3	31	43.06
		Team Total:	120	39	6	45	37.50
7	ETH	Men:	22	9	0	9	40.91
		Women:	32	18	3	21	65.62
		Team Total:	54	27	3	30	55.56
8	CAN	Men:	47	21	4	25	53.19
		Women:	52	17	4	21	40.38
		Team Total:	99	38	8	68	46.46
9	FRA	Men:	38	25	2	27	71.05
		Women:	22	6	1	7	31.82
		Team Total:	60	31	3	34	56.67
10	POL	Men:	45	15	1	16	35.56
		Women:	50	22	2	24	48.00
		Team Total:	95	37	3	40	42.11
Selected Others							
14	UKR	Men:	24	7	3	10	41.67
		Women:	60	15	3	18	30.00
		Team Total:	84	22	6	28	33.33

17	CRO	Men:	4	1	0	1	25.00
		Women:	11	7	1	8	72.73
		Team Total:	15	8	1	9	60.00
18=	CZE	Men:	24	10	1	11	35.83
		Women:	15	6	0	6	40.00
		Team Total:	39	16	1	17	43.59
23=	ESP	Men:	38	7	1	8	21.05
		Women:	19	2	1	3	15.79
		Team Total:	57	9	2	11	19.30
28=	ITA	Men:	19	3	5	8	42.11
		Women:	28	9	2	11	39.29
		Team Total:	47	12	7	19	40.43

To provide some historical perspective, PDIs have been calculated for the selected teams in all the major events of the last two Olympic cycles, starting with the 2008 Games in Beijing (Table 8). We can see that for the top teams PDI scores of 60 or more are the norm and Jamaica's average since 2008 is 74.52 whereas European teams achieve scores of 60 only on rare occasions (GBR 2015, POL 2015 and CRO 2015 and 2016) and most have averaged well below 50 over last decade.

Discussion

By the most popular measures of major event performance, it is clear that Europe's overall result at the 2016 Olympic Games in Rio de Janeiro was down from previous global championships, continuing the long-term trend that has seen more and more countries around the world enjoying success at the top-level. Europe's medal count went from 49 (34.0%) the year before at the IAAF World Championships in Athletics in Beijing to 36 (25.5%) and its total finalist points dropped from 654 (38.58%) to 559 (33.14%). The key factor is the absence of Russia from the Games, which it seems the other Area groups were able to profit from better than European teams.

With regard to the third performance indicator discussed here, the PDI, we see that in general Europe's top teams are not improving the percentage of times their athletes deliver on the basic objectives for their appearances on the track, road or field. From the data provided it is clear that athletes from a very large and diverse team like the USA and athletes from teams that are specialised in certain event groups, like Jamaica and Kenya, are able to consistently deliver 60% or more of the time. Only one top European team reached this standard in Rio and only two others reached 50%. Of the top nine European teams studied here, their PDI scores for Rio were down or roughly equal to their average for the previous six major events.

Europeans must be open to the fact that, regardless of much discussed perceived genetic, social or environmental advantages, the high-performance systems of some nations in other parts of the world continue to consistently do a better job of preparing their teams to perform and deliver success when it counts. It makes sense, therefore, that Europeans should give consideration to any and all factors influencing major event performance and what can be learned from others in order to make major or incremental improvements.

Table 8: Performance delivery data at major championships 2008-2016 for top teams at the 2016 Olympic Games

2016		2008 BEIJING -OG			2009 BERLIN -WCH			2011 DAEGU -WCH		
RANK		MEN	WOMEN	TEAM	MEN	WOMEN	TEAM	MEN	WOMEN	TEAM
1	USA	67.05	60.22	63.54	64.29	59.46	61.88	55.96	61.40	58.74
2	KEN	74.29	70.37	72.58	64.29	65.62	64.86	65.12	76.32	70.37
3	JAM	83.87	95.35	90.54	83.33	100.00	93.51	60.87	69.09	65.35
4	GBR	50.00	58.00	54.08	56.60	64.10	59.78	54.90	45.83	50.51
5	CHN	34.38	44.44	40.26	40.00	66.67	57.14	40.00	35.48	37.50
6	GER	29.63	41.67	36.51	33.93	51.67	43.10	43.90	55.00	49.38
7	ETH	52.38	44.44	48.72	52.00	55.17	53.70	42.28	46.67	47.46
8	CAN	41.94	47.06	43.75	47.37	42.11	44.74	25.00	41.18	33.33
9	FRA	48.48	38.46	44.07	47.76	36.59	43.52	57.89	38.89	51.79
10	POL	47.06	35.71	40.79	53.33	48.48	50.79	52.94	35.29	47.60
Selected Others										
14	UKR	22.58	37.74	32.14	15.58	26.32	21.88	31.58	36.07	35.00
17	CRO	20.00	28.57	25.00	33.33	60.00	50.00	0.00	40.00	25.00
18=	CZE	33.33	42.11	37.21	28.57	31.25	30.00	46.15	50.00	48.48
23=	ESP	35.56	37.93	36.49	30.23	46.15	36.23	32.43	22.22	29.09
28=	ITA	36.67	37.04	36.84	40.74	45.00	42.55	41.18	43.75	42.42
	RUS	35.59	45.87	42.26	34.62	49.02	44.16	40.91	55.33	52.34

		2016 RIO DE JANEIRO -OG			SEVEN EVENT AVERAGES		
RANK		MEN	WOMEN	TEAM	MEN	WOMEN	TEAM
1	USA	65.45	63.03	64.19	61.34	61.31	61.31
2	KEN	60.42	69.70	64.20	65.16	67.66	66.33
3	JAM	61.70	67.27	64.71	70.77	77.11	74.52
4	GBR	50.88	61.90	56.67	53.00	59.00	56.04
5	CHN	41.18	35.29	38.24	39.17	44.52	42.55
6	GER	29.17	43.06	37.50	37.70	50.14	44.49
7	ETH	40.91	65.62	55.56	46.33	56.82	52.29
8	CAN	53.19	40.38	46.46	50.20	41.83	46.05
9	FRA	71.05	31.82	56.67	53.90	45.80	50.66
10	POL	35.56	48.00	42.11	48.70	43.83	46.69
Selected Others							
14	UKR	41.67	30.00	33.33	26.53	35.97	32.53
17	CRO	25.00	72.73	60.00	15.95	55.19	40.32
18=	CZE	45.83	40.00	43.59	38.18	42.92	40.69
23=	ESP	21.05	15.79	19.30	28.61	34.11	30.76
28=	ITA	42.11	39.29	40.43	37.25	42.25	39.66
	RUS	DNC	DNC	DNC	44.00	42.65	47.89

2012 LONDON -OG			2013 MOSCOV -WCH			2015 BEIJING -WCH		
MEN	WOMEN	TEAM	MEN	WOMEN	TEAM	MEN	WOMEN	TEAM
59.82	67.54	63.72	63.06	61.79	62.39	53.78	55.75	54.74
61.54	60.61	61.11	59.52	75.76	66.67	70.91	55.26	64.52
65.85	68.18	67.06	74.47	64.44	69.57	65.31	75.41	70.91
47.76	52.54	50.00	55.32	63.41	59.09	55.56	67.24	62.14
33.33	43.75	38.98	37.93	44.12	41.27	47.37	41.86	44.44
36.84	52.94	46.07	51.22	46.67	48.84	39.19	60.00	50.00
42.31	65.22	53.06	50.00	57.69	53.85	44.44	62.96	53.70
54.55	37.50	46.15	64.52	38.46	52.63	64.86	46.15	55.26
45.45	58.33	50.00	51.02	59.38	54.32	55.63	57.14	54.24
29.41	36.36	32.14	51.52	50.00	50.88	71.05	52.94	62.50
20.00	33.33	28.36	28.00	45.83	39.73	26.32	42.50	37.29
0.00	60.00	30.00	0.00	50.00	28.57	33.33	75.00	63.64
26.32	45.83	37.21	55.26	55.56	55.00	31.82	35.71	33.33
25.00	50.00	35.19	35.29	53.33	40.82	20.69	13.33	18.18
45.00	47.37	46.15	40.74	50.00	45.10	14.29	33.33	24.14
47.17	49.98	48.34	51.85	55.67	54.90	53.85	38.30	45.35



FACTORS INFLUENCING MAJOR EVENT PERFORMANCE		
Structural	Elite Preparation	Event Related
<ul style="list-style-type: none"> • Long-Term Athlete Development Model • Talent Identification System • Coach Education • Coach Management and Support System • Facilities and Equipment • Competition Structure • Grass Roots Athletics Structure and Activities • National Athletics Culture 	<ul style="list-style-type: none"> • Quality of Coaches • Training Methodology • Recovery and Regeneration • Competition Programme Planning • Nutrition • Medical Monitoring and Support • Sport Psychology and Mental Training • Dual Career Arrangements • Financial Security • Sense of Purpose and Urgency 	<ul style="list-style-type: none"> • Team Selection • Training and Final Preparation Camps • Travel Arrangements • Acclimatisation • Hotels and Meals Arrangements • Tactical Preparation • Physiotherapy • Team Spirit

Conclusion

The long-term trend shows that the shares of medals and finalist points going to European countries are shrinking in the face of increased competition from the rest of the world. The Performance Delivery Index, or PDI, data presented in this article shows that athletes from the countries taking a large share of the medals that European teams would have expected to take in the past are more effective at delivering performances that meet the basic objectives for each appearance at a major championships. National performance directors, head coaches and athlete support personnel would do well to consider all factors that impact athlete performance to see where systematic improvements can be made. The PDI, which provides an additional assessment tool that looks beyond the final position achieved by a relatively small number of athletes and encompasses every performance by every athlete on a team may be useful for measuring the incremental improvements that performance professionals are seeking.

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Notes

1. See DICK, F. (2012) Olympic Performance Assessment – A European Perspective. *New Studies in Athletics* 27:4, 25-40 and GLAD, B. & LOCATELLI, E. (2015) IAAF World Championships in Athletics Performance Assessment – A European Perspective. *New Studies in Athletics* 30:1, 53-72. The data in both articles has been seriously compromised by the various retroactive disqualifications. For this article we have used the most recently updated results available.

2. Note that the standing on the official medal table is determined by the number of gold medals, then the number of silver medals. This explains why France, with a total of six medals but no golds was ranked 21st overall.

3. This concept was introduced in DICK, F. (2012) and modified in GLAD, B. & LOCATELLI, E. (2015).