GOLF COURSE 2030
GREAT BRITAIN & IRELAND

ACTION PLAN

COURSE CONDITION AND PLAYABILITY

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# COURSE CONDITION AND PLAYABILITY

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1. INTRODUCTION

There have been many great achievements in the world of golf during recent times, such as inclusion in the Olympic Games for the first time in over 100 years, showcasing the sport on a global platform, and record spectator attendance at various major golf events. However, such accomplishments have been achieved amongst a landscape of increasing pressures which threaten the sustainability of the game, including falling participation numbers and a series of environmental concerns. It is important the golf industry recognise the pressures affecting the game and take the appropriate steps to secure the future sustainability of the sport.

Golf Course Condition and Playability is the cause of much debate between agronomists, designers, architects, green keepers, and, of course, the players themselves. Green surfaces, in particular, are seen as the hallmark of quality given their focal point for each hole. The purpose of this action plan, therefore, is to outline the industry needs regarding Course Condition and Playability in line with the R&A Golf Course 2030 strategy, by drawing together the relevant academic and industry research undertaken in the area to establish the current level of understanding. This process involved analysing:

I. Academic research papers published on Course Condition and Playability, and wider sports work where appropriate.
II. Industry publications and market research produced by various sports turf related organisations.
III. Survey research conducted with a range of key industry stakeholders.

2. METHODOLOGY

The research design used is a case study approach involving an in-depth analysis of factors which impact on golf Course Condition and Playability. An extensive review of academic evidence was conducted via searching abstract and citation databases of peer-reviewed scientific articles, including Scopus, SPORTDiscuss, PubMed, PsycINFO, Taylor & Francis Library, and Google Scholar. This combined strategy covers more than one million citations of academic peer-reviewed research papers. Industry publications and market research documents were either publicly available or accessed via contact directly with the relevant bodies.

The academic and industry literature was supplemented with survey research from 16 key industry stakeholder organisations. A self-completion questionnaire was developed with areas covering key factors in managing course condition and playability, the impact on overall golfer experience, and industry views on a set of defined quality standards.

All participants were invited to take part and briefed on the nature of the research. Responses were anonymous and participants had a free and impartial choice for each question. The results were subjected to a number of statistical tests and coded with the literature review via a process of thematic analysis, where reoccurring points of significance and emergent trends were identified to build a coherent evidence base.
The action plan was commissioned by The R&A and granted ethical clearance by University Centre Myerscough’s Faculty Research Ethics Committee (FREC). Participants were given a guarantee that all data will remain confidential, thus contributing to enhanced overall validity.

3. LITERATURE REVIEW

3.1 Player expectations and demands on course condition and playability

The evidence shows that importance placed on quality of course condition and playability varies considerably given the skill level of the golfer involved.

Buksted (2019) has collated 1.3 million survey responses from existing, new, and lapsed golf club members and guests across 1,500 golf clubs in 12 different countries. Participants were asked questions about player satisfaction of the course, clubhouse, management, food and drink, facilities, lessons, and membership options.

Results show that players of all levels appreciated a ‘reasonable’ minimum standard of course quality, which, should conditions fall below this there would be cause for members to complain. It is, of course, difficult to quantify what is viewed as ‘reasonable’ in this context, but for this research a course condition benchmark ranked as 72/100 was identified (Buksted, 2019). When the data was interrogated further to take into account skill level, however, importance on course quality varied.

3.2 Course condition and playability: Regular and committed golfers

It was those golfers who were playing off a handicap of 10 or less who placed high importance on the quality of course condition and playability. Specifically, the following areas were viewed as critical for a good golfing experience:

- course well maintained
- course varied and exciting to play
- fairways are excellent
- greens are smooth and ball rolls as it should.

This argument is supported by market research conducted by Syngenta (2014, 2016), that found that best course conditions are demanded by 80% of people who described themselves as ‘committed golfers’.

Syngenta (2014, 2016) collected 14,000 surveys with golfers (female and male), female non-golfers, lapsed female players and women who had tried golf a couple of times. Survey responses were supplemented with qualitative data and face-to-face focus groups. Regular golfers identified the following five factors as the most important aspects of on-course condition:

- greens roll smoothly
- course design
- golf course is visually appealing
- high probability of finding ball in the rough within a reasonable time
- course blends naturally into its environment.
A good minimum level course condition and playability, therefore, is a particularly critical factor for regular golfers of a higher skill level, and a club’s ability to provide an enjoyable and memorable on-course golfing experience is likely to define a club’s reputation with this group.

Research has gone so far as to suggest that course condition and playability can have significant positive impact on a golf club’s total revenue, particularly in relation to number of guests becoming repeat consumers (Buksted, 2019; Shmanske, 1999).

It is important to recognise that this issue is complicated by the level of subjectivity involved in, for example, considering the visual aesthetics of a golf course, where the perceived condition and beauty of a golf course are primarily determined by individual preferences and tastes (Huth & Kurscheidt, 2018).

A seminal research paper conducted by Wheeler and Nauright (2006) reveals how perceptions of golf course condition and playability are a product of the social context. Specifically, it is argued that the role of the media and their portrayal of golf, which has intensified during the television (and more latterly, the social media) age plays a major factor in shaping public perceptions of golf and associated expectation level of the courses where it is played (Wheeler & Nauright, 2006).

Original golf courses are said to have been shaped by the existing landscape, grasses fertilised by the droppings of breeding seabirds, cut short by grazing rabbits, and hazards such as bunkers formed by animals burrowing into the turf (Wheeler & Nauright, 2006). It is argued that the rise of media coverage has changed perceptions on how golf courses should look, however, and nurture unrealistic expectations of perfectly manicured facilities in an artificial environment.

The result is those providing golf are under pressure to maintain immaculate courses, by those who may be prone to complain about less-than-perfect course conditions when annual membership fees remain high (Wheeler & Nauright, 2006). With this in mind, it is extremely important to manage expectations of golf course construction and playability, given ultimately this is a product of media portrayal and expectations and can be changed.

3.3 Course condition and playability: Social golfers

The important point raised by Buksted (2019) and Syngenta (2014, 2016), however, is that those golfers who prioritised high quality standards in course condition were often very in small number, however, they tended to be those who “shout the loudest”.

The reality is such that most golfers do not prioritise course condition beyond the ‘minimum reasonable level’ and rather focused on the quality of the club environment and social activities. Buksted (2019) argues that the revenue expenditure allocated to course maintenance in a typical club (around 80% of overall expenditure) is too high, and larger percentage should be redistributed more social activities.

When asked what would encourage golfers to play more, ‘course condition’ ranked relatively low, as the 11th most important factor, identified by 9% of respondents (Syngenta, 2016).

Social relationships are described as being the ‘glue’ of a golf club and focus therefore should be made on building relationships and new member integration (Buksted, 2019). In short, Buksted (2019) concludes that it is much easier to leave a good quality course, than it is to leave a good quality social community that a golf club can facilitate.
3.4 Factors around course set up

Interestingly, the quality of course condition was not cited as a reason for non-participation by golfers who had previously played and now given up the sport (Syngenta, 2016). This group of golfers did, however, explain that course ‘set up’ was a factor, where facilities tend to be arranged in a way to challenge experienced golfers rather than for beginners (Syngenta, 2016).

Research by Forbes (2014) develops this viewpoint to argue that the design of a golf course has a direct impact on membership retention. Furthermore, the majority of golfers are at a novice or intermediate skill level, but most golf courses are designed for experts. Via interviewing a number of golf course architects, results show that the following aspects of course design can deter the majority of golfers:

- forced carries
- difficult water hazards
- deep bunkers
- greens surrounded by rough.

It was concluded that a golf course with an interesting and variable layout that aims to accommodate all levels, through strategic placement of tees, for example, is more likely to satisfy golfers rather than one of high difficulty and increased length – which would appeal to a relatively small demographic (Forbes, 2014).

Research by Huth and Kurscheidt (2018) compared course condition and playability differences between golf club members and nomadic golfers (who would pay and play at different venues rather that remaining loyal to one), and also took into account the skill level involved.

Results indicate that golfers of a higher skill level, both club members and nomadic groups, value the difficulty level of their course. There was, however, a difference in the members and pay and play golfer’s interpreted ‘difficulty’, where members evaluated a course’s general difficulty not merely its length, but also considered number/placement of bunkers or water hazards, the trees around the fairway, and general topography of the holes. Pay and play golfers, conversely, measured the difficulty of a course by referring to the average length of holes and overall course length in total.

Research by Huth and Kurscheidt (2018) corroborates with Buksted (2019), who also found course condition and playability to be more important for one off visitors to a golf club, who are more likely to assess the course quality rather than other aspects such as the club atmosphere or experiences, given this is not central to their motivations for playing.

Research by Lyu and Hwang (2017) aimed to rank golf courses into ‘difficulty levels’ associated with several specifications, with a view to see the importance placed by different groups. These levels included:

- low: short course length, few sand bunkers and water hazards, easy green speed and undulation (intrapersonal constraint associated with lack of golfing skills and abilities)
- medium: moderate course length and fairway width, some sand bunkers and water hazards, ordinary green speed and undulation
- high: long course length, narrow fairway width, many sand bunkers and water hazards, difficult green speed and undulation.
Results indicate that ‘casual’ golfers showed the strongest preferences for easy course set-up and demonstrating their dislike for the high levels of difficulty. These golfers tended to be less skilled and thus preferred easier course specifications, to help negotiate the constraining factor associated with their limited golfing abilities and increase overall enjoyment levels. Conversely, the intermediate and committed golfers indicated less dislike for the most difficult course settings (Lyu & Hwang, 2017). Course design factors, such as being able to find a golf ball quickly in the rough, also raises important questions around speed of play (Syngenta, 2014).

So far, this review has outlined the player expectations and demands on course condition and responsibility. It is important to state there is a lack of robust scientific data in regard to player expectations of course condition and playability, where much of the evidence presented here is derived from industry publications, and thus this is a fertile area for peer reviewed research projects to be conducted.

3.5 Performance Measures for Golf

The diverse range of surfaces on which golf is played makes a description of performance criteria difficult. In agriculture, the objective in crop production is one of yield, the amount of usable or saleable produce from a given area. In sportsturf management, however, the aim is to produce a playing surface for sport which cannot be defined in plant biomass terms but must be considered in terms of the actual quality of playing surface produced (Canaway, 1994). Professionals working in the sports turf industries have developed performance or playing quality measures for golf over many years, but not everyone in the industry is agreed about the use of these.

Arthur (1994) maintained that there should be more focus on minimum standards for materials and construction methods rather than an emphasis on playing surface measurements when in use. This belief is based on the assumption that if playing surfaces are built with quality materials to precise specifications then surfaces will provide good playing conditions. Dury (1994) argued that performance measures can be used to develop and maintain surfaces better when in use; that their implementation would raise standards of management and subsequently playing surface quality. Today most people utilising any form of performance measure are doing so from the standpoint of increasing the quality of playing surfaces in use, in an attempt to increase standards of provision. A further problem identified by Lodge (1994) is that golfers have differing views as to what constitutes a good or bad golf green. Performance measures, however, do provide a means of setting objectives and monitoring the condition of facilities so that management decisions can be made based on factual data rather than subjective observation. This is a more scientific approach and relies more on ‘hard’ measured data rather than the opinion of the players or greenkeepers alone. This can only be a sound basis for management. Such measures can be used to identify any deterioration in surface quality and guide future actions. This in turn should lead to more effective resource utilisation and management.

The visual appearance of a golf course is, for many, the key indicator of playing conditions. Assessment of golf green visual quality can be done by asking people their own subjective opinion, which Lodge (1994) maintained is basically market research. Aesthetic appeal is, however, highly subjective and it is not uncommon for golf greens to be criticised without reference to the criteria which reward skill. Hayes (1990) summarised some of the attributes (Appendix 1) of good playing surfaces for golf; some of which can be made quantitative, for example those relating to ground cover and drainage characteristics.
Most work on playing characteristics has concentrated on golf greens for it is these that by and large are said to determine the playing quality of a course. Playing quality can be defined as the characteristics of the turf surface which make it suitable for the sport in question, as measured by relevant technical tests or as perceived by players. The measurement of green speed is undoubtedly the most widely used assessment of performance for golf greens.

Apart from golf greens the only other areas that have been considered to any extent in the United Kingdom (UK) are bunkers and specifically sand characteristics. Visual impact is the first and often lasting impression. The primary standard is the ‘expected’ one, conditioned by the experience of player and spectator. Excellence as it is perceived can be achieved in different ways. Hacker and Shiels (1992) focus strongly on the way sound techniques in maintenance and attention to detail can raise the general standard, albeit presentational aspects, of greens, tees and fairways.

The Institute of Groundsmanship (IOG, 2003) offer several benefits for having performance measures on golf courses including that of allowing managers to make realistic comparisons between courses and to counter comments about one course supposedly being better than another. This, though, is a contested concept. They also consider that such standards:

- provide managers with an aide in budget negotiations (as evidence can be used to argue for a change in staff, materials or machinery if a different standard or overall quality is desired)
- enable efficiency in staffing deployment (as staff utilise their time more effectively in achieving the desired results by having a well-defined end product)
- provide a suitable basis for drawing up detailed work programmes (and allow for an accurate assessment of resource requirements).

The Sports Turf Research Institute (STRI) have developed some objective assessments, including some from earlier methods and existing tools, for the playing quality of golf greens (Isaac, 2012). These are really the only objective measurements of playing quality available to golf course managers. Assessment of other areas are not developed to any meaningful level. The Institute of Groundsmanship (2003) have proposed other measures for golf greens (and other areas) but these have not generally been adopted in golf course management and tend to focus on structural properties as opposed to objective measurements of presentation or playing quality.

Appendix 2 summarises the current industry quality assessment methods for golf greens and other areas of the golf course.

**3.6 Performance Management**

Managers are expected to make improvements within operations to improve output quality and also to assist in efficacy of resource utilisation. Commercial companies and organisations will only survive if they create and retain satisfied customers (Hoyle, 2007) and this is true for golf clubs (England Golf, 2014). Customers demand that products and services of a required standard are available when they want them and at a price that they believe gives value for money. Consumers need to be certain that they are buying a quality product or service and are more discerning with their cash in a competitive market place whilst producers need to fulfil ever-increasing user expectations and requirements in order to survive or prosper. The golf industry has not escaped this phenomenon and in recent years, there has been an increasing awareness, development and use of performance measures. Some of this has been prompted by the growth of contracting but also due to developments in technology, media
coverage and increasing demands of players and coaches for better quality surfaces, particularly in professional sport (Brown, 2009).

In operations, quality is seen as consistent conformance to customer expectations and requires both a clear specification and consideration of golfer views which may be influenced by price. Bridging the gap between golfer expectations and that product (course quality) or service actually delivered is key in operations terms for organisational success. Standards dictate what should be done but without measurement one cannot assess performance or the quantity or quality of an output. To manage quality, one needs to be able to effectively measure it. Whether it be quality of a product, service, process or system without measurement we will not know if we are getting better, worse or staying the same (Hoyle, 2007). Measurement is a process whereby numbers can be ascribed to physical quantities and phenomena. Abstract characteristics such as quality need to be translated into quantities so that they can be measured. Standards expressed in measurable terms can be measured for conformity. For golf greens some aspects of performance quality can be defined in measurable terms whereas in other areas of the golf course this is often more subjective including aesthetic qualities which are difficult to even define let alone quantify.

Measurement is vital to the achievement of quality and this must be done with measures or tools that are fit for purpose. If measurement is done with instruments that are not fit for purpose results will be misleading or not valid. Valid measurements allow for decisions to be made on the basis of facts and whether standards or targets have been met. There must be a target value with which to compare results, measurements without such are meaningless (Hoyle, 2007). Measurement tells us whether there has been a change in performance.

The only drawback with performance measurement is that it does take staff and time to execute and this should not be forgotten by management. The whole process of collecting data and analysing performance should be continuous. Goals and standards should be increased as performance improves or changed as activities change. Slack, Brandon-Jones and Johnston (2013) also recognise issues that may arise in implementing performance measurement within organisations. They state that from 50-80% of performance management programmes fail because of lack of support from senior management; lack of understanding; excessive or unrealistic expectations from the process and unforeseen implementation problems. Golf course managers may see performance assessment as a criticism of their practice and decision making. This is an area for which there is some anecdotal evidence but one which has had no primary research.

In a study of municipal golf in 2001 Mort and Collins looked at managerial aspects relevant to Best Value under which the courses were being managed at that time. They looked at three groups of performance standards:

- access – showing the use by different groups and the effectiveness of policy to combat social exclusion
- financial – representing indicators of efficiency and economy
- utilisation - showing the scale and nature of the use of the facilities and indicating effectiveness and efficiency.

This is one of the few studies of its type and is limited to a few municipal golf courses in England and did not consider surface performance or quality. The study has little direct relevance to operations management, but it might assist in developing performance management for golf clubs at a strategic level.
3.7 Benchmarking

Benchmarking is an increasingly popular improvement tool (Goetsch and Davies 2010). Slack, Brandon-Jones and Johnston (2013) suggest also that benchmarking need not be competitive where done with organisations which do not compete directly in the same markets. Goetsch and Davies (2010) argue that benchmarking must involve partnering with best in class so that you can adapt processes for your own operations without having to spend time and money trying to design a duplicate of the superior process. They believe internal benchmarking to be re-engineering which should be done only when partnering with best in class is not possible. There is little point in entering into the benchmarking process unless there is a real desire by management to achieve these things. Benchmarking can be built into an organisation's strategic planning as a mechanism for achieving continuous improvement. Organisations need to make resource and structural provision for implementing improvements that emerge from the benchmarking process. The philosophy of improvement needs to be owned throughout the organisation and most of all by management for this process to have real effect.

Inevitably in considering operations performance in facility management a benchmark to measure against is a first consideration. In fact, the word benchmarking is often used to describe performance measurement itself.

“A benchmark is a reference or measurement standard used for comparison, whilst benchmarking is the continuous activity of identifying, understanding and adapting best practice and processes that will lead to superior performance” (IOG, undated, p4)

The Institute of Groundsmanship maintain that their own performance quality measures are reference standards against which a particular facility can be compared, and that Benchmarking provides a turf manager with a process that aids in identifying areas for improvement.

Isaac (2008, p.8) has likened benchmarking to human fitness when considering its relevance to golf course management.

"Benchmarking could be considered the golf course equivalent, whereby the impact of inputs on its performance are measured and compared year after year. In much the same way as we use tools to measure our fitness, e.g., devices to determine heart rate, blood pressure, the dreaded scale, and so on, implements are necessary to assess the health of our turf".

Golf course managers can measure drainage rates, organic content, and other factors relating to the physical condition of the grass but must also assess how the turf performs for the golfer. Devices to measure the firmness of turf and the trueness of putting surfaces have been developed. These and other tools could also take their place in the turf industry as the Stimpmeter, for measuring golf green speed, has become part of the nomenclature of golf and turf management. Measurements for a variety of “quality” characteristics have been developed for golf but there are as yet no “universally” agreed set parameters for conformance, albeit the parameters for golf green speed as determined by the Stimpmeter are generally accepted world-wide.

To achieve these objectives measurements must be based on both objective data and subjective data and consider both services and the general working environment. Benchmarking is identified as one of the raft of measurement systems which can be used to measure the efficiency, effectiveness and economy of land related service provision and
delivery. A key part of benchmarking procedure is the analysis of results which should aim at identifying the reasons for any important differences between the benchmark operation and the operation being measured (Kincaid, 1994). This gap analysis then is the basis for a review and improvement of the processes involved in the operation. Action plans can then emerge from this analysis and following implementation further measurement to assess the changed process. Resistance to benchmarking is quite evident among some sections of the horticultural profession including golf course management. It is claimed there are too many variables associated with growing things, and with amenity usage, to enable any meaningful comparison to be made. Davies and Girdler (1999) state that it is difficult to fully accept this sort of argument when success has been achieved with other highly variable activities such as fish farming, dolphin training, ski-slope management and land reclamation which have retrospectively been benchmarked against car manufacturing, basketball training, fast-food enterprises and open-cast mining systems.

3.8 Developing a Performance Management Framework for Golf Courses

In managing sport and recreational surfaces Dury (1997) states that there is a need to develop performance management systems for both existing facilities but also in developing new ones. Such systems need to be versatile and flexible to accommodate varying circumstances. Recording, monitoring and analysing operations enable management in resource decision making. The system should enable incorporation of a series of indicators which are interrelated. There should be a clear link between operations management and key performance indicators used in performance measurement (Slack, Brandon-Jones and Johnston, 2013). Performance objectives and measures can be aggregated into composite measures which will have greater strategic relevance as they assist in compiling an overall picture of the business and its performance. In developing a performance management framework for golf courses, one must identify the measurable criterions of quality to be used as well as determining how inputs and costs can be calculated and incorporated. The primary need is a performance management framework that can be easily adopted by course managers at the operations level to manage resource inputs with quality standards and where required, be used as a comparator of performance in a benchmarking context. The key components required for a performance management framework for golf courses need to include operations practices, input costs and quality assessments or standards.

In considering existing performance management frameworks, it has been found that none provide a specific tool that could be used to model, control, and monitor and improve the activities at the operations level (Ghalayini, et al.1996). Further in the review of literature it has been found that no such framework has yet been fully developed and adopted within golf course management for use at an operations level. Such a framework has ramifications for professional practice to the extent that it would allow golf course managers to critically assess their own operations management practices and identify where possible efficiency savings in resource inputs can be made.

4. INDUSTRY CONSULTATION

A number of key industry stakeholders were consulted during the production of this Action Plan. Specifically, a self-completion questionnaire was sent to the following organisations:

British and International Golf Greenkeepers’ Association (BIGGA)
British Agrochemical Standards Inspection Scheme (BASIS)
Club Managers Association of Europe (CMAE)
European Institute of Golf Course Architects (EIGCA)
England Golf
European Tour
Golf Club Managers Association (GCMA)
Golf Course Superintendents Association of Ireland (GCSAI)
Golfing Union of Ireland (GUI)
Golf Foundation
Ladies European Tour (LET)
Professional Golfers Association (PGA)
Scottish Golf
Sports Turf Research Institute (STRI)
Register of Independent Professional Turfgrass Agronomists (RIPTA)
Wales Golf

All participants were invited to take part and briefed on the nature of the research. Responses were anonymous and participants had a free and impartial choice for each question. The data was subjected to a number of statistical tests and the key points of significance and emergent trends are identified here.

4.1 Key factors in managing course condition and playability

Participants were asked how important they viewed physical resources (equipment and machinery), human resources (staffing), and financial resources (budgets) in regard to maintain course condition and playability. Figure 1 shows the mean average weighted score for business area, split by “green” and “other course areas”, where the higher the number the more important it is considered to overall course condition and playability.

![Figure 1](image)

**Figure 1** Key factors in managing course condition and playability

“Human resources” were ranked as most important factor in maintaining the condition and playability of “greens” (4.36) and “other areas” (4.8) including fairway, rough, and hazards.

“Financial resources” were ranked as the least important factor with “greens” (3.67) and “other areas” (3.42).

“Physical” resources such as equipment and machinery were ranked as medium priority with “greens” (3.88) and “other areas” (4)

The results indicate the importance of high-quality skills in regard to course condition and playability, which can make up for limited resources. Interestingly, human resources were
considered even more important for other areas of the course including fairway, rough, and hazards.

This said, given the limited deviation from the midpoint, it is clear that the overall consensus is all factors are of importance, and have to be combined appropriately.

4.2 Overall golfer experience

Participants were asked which specific areas of the course were considered most important in relation to overall golfer experience. Figure 2 shows the mean average weighted score for each course area, where the higher the number the more important it is considered to overall experience.

![Course condition and playability by golfer](image)

Results show “Greens” were considered as the most important factor in player experiences (5). This was followed by “Hazards” (4.5) and “Fairways” (4.33).

The least important factor identified was “Green approach/aprons” (3.38) which was ranked slightly lower than “Teeing areas” (3.63).

4.3 Defined quality standards

Participants were asked for their thoughts on a defined quality standard for golf greens. This would include, for example, accepted industry guidance on the quality of various aspects of the golf course (greens, fairways, tees) in relation to a standard rating of the course (based on cost to play).

Figure 3 reveals a fairly mixed response to the concept of an industry wide defined quality standard.

Overall, more than half of participants (54%) believed quality standards to be beneficial for golf courses (“Very desirable = 31%, “Desirable” = 23%)

Alternatively, around a third of participants (31%) said such standards would be either “Undesirable” (23%) or “Very undesirable” (8%).
Additional comments on this question centred on how, exactly, would a defined quality standard be reached given some quite often differing optimal course conditions:

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<th>Comment</th>
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<td>“Context is critical … quality and performance cannot be considered without other considerations … weather, golf course design, willingness to develop the course, maintenance strategy, constraints such as budget, usage levels, etc.”</td>
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<tr>
<td>“Quality standard should also consider grass species, and inputs of water, and chemicals (from fertilisers to pesticides). Again, what’s vital is the forward look … what’s best in the future circumstances”</td>
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<tr>
<td>“Golf courses in different areas and regions will each have different optimal conditions … possibly/probably better to concentrate on sustainable environmental standards that provide optimal course conditioning for courses’ unique environment”</td>
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<td>“Desirable, but needs a lot of thought and discussion as to what a standard might be or look like … such a standard should be defined by use of objective measurements, such as trueness, firmness, and moisture levels”</td>
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<tr>
<td>“All golf courses are different, for the simple reason they are part of the natural environment located in different places. The optimum ‘condition’ of a green in one location will be different to another … An environmental quality standard (e.g. GEO) on the other hand is and will be extremely valuable”</td>
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4.4 Key research and required action

Participants were asked what important actions and research should be prioritised over the next 10 years on the topic of course condition and playability.

Two key themes emerged from the questionnaires, which related to, firstly, effective standardisation procedures and how these could be communicated to across the sector and, secondly, approaches on how best to maintain course standard in light of growing pressures from a variety of groups:
1) Effective standardisation and communication across sector

- “Standardisation and ‘how to’ guides for clubs and greenkeepers”
- “Education and communication of the relevant factors that influence optimal conditions - to clubs and then also the golfing public”
- “Effective communication throughout the golf network, including the engagement of visible professionals and administrators”
- “A broader picture of what is happening in the industry and not a blinkered view which has almost certainly confused the industry”
- “Leadership across all major sports on adapting to environmental change”
- “Relationships between maintenance strategies and quality”

2) Maintaining course standards in context of growing pressures

- “Ability to maintain standards despite restrictions on water, fertiliser and changing climate conditions”
- “I think we need to look hard at the coming pressures from hotter, drier summers; reduced availability of water for irrigation; and increased restriction on previously widely used chemicals, and move towards more sustainable approaches”
- “Golfer pressure is likely to be a drag factor on this, and it’s therefore also vital that we find compelling and effective ways to help the golfer understand that it’s essential, and that some pain during the process is inevitable, but worth it in the long term”
- “We need golfers (and many in the profession) to accept that these challenges are real, and that fighting them through ever more intensive applications of water and chemicals is not the way to go”
- “How can quality be interpreted in the context of wider regulatory and environmental changes”

5. RECOMMENDATIONS FOR ACTION

The academic research, industry documents, and key stakeholder questionnaires included in this action plan revealed a number of recommended areas for action. These are organised as short, medium, and long-term objectives below:
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<th>Research</th>
<th>1) Player Survey Research</th>
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<tr>
<td></td>
<td>Golfers themselves are the key driver of course conditions, and thus a detailed analysis of their wants and needs are very important in this regard. This would include golfers of varying skill levels, across a range of different courses, to establish the value placed on course condition and playability across different key golfer demographics important to the future success of golf. It would also be possible to gauge the impact of changing course maintenance practices across different course areas (such as reduction in watering course or mowing out of play areas) on golfers’ satisfaction/motivation levels.</td>
</tr>
<tr>
<td></td>
<td>This also starts to engage with golfers about the project in general and about the challenges. This research must help them appreciate that there are massive pressures coming and that it’s essential for the industry to change its approach. We need to change their expectations, in the context of climate change, resource constraints (such as water shortages) and regulation, as identified by GC2030.</td>
</tr>
<tr>
<td></td>
<td>Golf club committee members, as key decision-makers, should be targeted in the survey to influence their approach to course condition and playability.</td>
</tr>
<tr>
<td>2) Golf Green Quality Standards</td>
<td>Golf organisations, with a grasp of the GC2030 context, to agree real world performance measures and standards to be used in assessment of golf green quality. Several objective measures of golf green quality already exist but there needs to be consensus on which ones should be adopted by the industry and at what level of performance. This might usefully include “expected standards” for different levels of provision. Such measures should be used to inform a future Performance Management Framework and should only include protocols and equipment easily accessible to ALL golf course managers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities for Education &amp; Publicity</th>
<th>1) Workshops/Seminars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To inform/educate both golfers and greenkeepers:</td>
</tr>
<tr>
<td></td>
<td>there needs to be a better awareness from golfers (including PGA members) as to what can be realistically measured and assessed in terms of golf green quality and also of what they can expect. Greenkeepers need to be fully conversant with the defined standards and protocols for assessment including methods of data analysis and dissemination to inform players.</td>
</tr>
<tr>
<td></td>
<td>Messaging needs to be consistent and delivered across the industry.</td>
</tr>
</tbody>
</table>
2) Marketing & Learning Materials

These could be developed to inform players (including club professionals) and greenkeepers, for example:

- posters for Golf Clubs regarding Golf Green Assessment
- factsheets for Golf Green Quality Assessment (Protocols and Standards) for Greenkeepers and Education providers.

It should be noted that the golfers first port of call for information is often the PGA Professional at a club and it would be helpful if they are aware of these issues and can direct people to resources.

2) Medium term (2 years)

<table>
<thead>
<tr>
<th>Research</th>
<th>1) Developing Quality Standards for other Golf Course areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This research would seek to produce a coherent and consistent set of real world standards for various areas of the golf course environment, including, for example, tees, fairways, green aprons, rough, etc.</td>
</tr>
<tr>
<td></td>
<td>There is little to nothing known about other areas of the course. This is particularly important given the amount of land dedicated to such areas.</td>
</tr>
<tr>
<td></td>
<td>This research would draw together an agreed standard of provision and associated measurement methods. Such measures should be used to inform a future Performance Management Framework and should only include protocols and equipment easily accessible to ALL golf course managers.</td>
</tr>
<tr>
<td></td>
<td>2) Identifying Resources Inputs and Impact on Course Condition &amp; Playability</td>
</tr>
<tr>
<td></td>
<td>What level of input can achieve quality surfaces? It may be that quality can be achieved with lower resource inputs but this needs objective assessment and measurement. This project needs to identify the key inputs for course condition and playability, consider how to measure input level against standard of surface performance and review the impact of reducing key inputs.</td>
</tr>
<tr>
<td></td>
<td>Case study research could provide examples of how golf course managers might usefully manage their courses with reduced inputs and achieve desired levels of quality.</td>
</tr>
<tr>
<td></td>
<td>This research is fundamental to addressing the 3 scenarios stated by The R&amp;A (see Appendix 3) which consider possible future reductions in resources (including sand/chemical products and water).</td>
</tr>
</tbody>
</table>
### Opportunities for Education & Publicity

Examples of management practices courses derived from “exemplar golf courses can be used to inform practice.

Practical guidance for greenkeepers including resource procurement and management. Minimum levels of input required for prescribed methods and materials together with alternative resources. Education in technological systems and methods facilitating more efficient resource utilisation.

### 3) Long term (3 years)

#### Research

1) **Development of Performance Management Framework (PMF) for Course Condition and Playability**

A performance management framework would help support golf club managers and green keepers in making decisions around course condition and playability, in regard to the resources each individual facility has at their disposal.

Golf courses could be categorised according to the type of venue, based on their landscape characteristics and target market, with a corresponding minimum expected standards.

This framework would allow for greater clarity of communication between staff, such as club managers and green keepers, and ensuring a coordinated approach to course condition and playability.

*See Appendix 4 for preliminary draft example of proposed framework.*

2) **Development of “Best Practice” Guidelines for Golf Course Management**

Support and guidance on how to manage courses and attain desired standards would help course managers and other club officials to manage resources effectively. Best Management Practices can incorporate advice and guidance on course management practices (greenkeeping) and also wider environmental, legislative and sustainability issues. Such guidance must be real world based in the context of GC2030 and should not simply promote the status quo. A GB & Ireland* document could be developed akin to those being developed in the USA.

*Brexit will likely affect specific content so separate UK and Ireland documents may be needed.*
<table>
<thead>
<tr>
<th>Opportunities for Education &amp; Publicity</th>
<th>Publication of Golf Course Management Framework &amp; Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance management framework circulated to golf industry. Accompanied by series of educational workshops to develop practice. This would raise awareness of both the existing and emerging research in a practical and applicable setting.</td>
<td></td>
</tr>
<tr>
<td><strong>Publication of Golf Course Management Guidelines</strong></td>
<td></td>
</tr>
<tr>
<td>These could lead to enhanced provision for golf and achievement of desired industry outcomes for sustainability and more effective resource utilisation</td>
<td></td>
</tr>
</tbody>
</table>

6. CONCLUSION

Golf greens are the most significant area on the golf course for both play and intensity of maintenance practice (Beard, 2002; Hurdzan, 2004). They are also one of the few areas of the golf course for which there are objective measurements of quality. Quality of greens being one of the (if not the) most important factors by which players judge golf course “quality”. Industry press in the UK has focused almost entirely on initiatives such as the STRI’s Golf Performance Management System (a collection of golf green quality assessment methods) which focuses entirely on golf greens. Measuring the quality of golf greens has been described by Windows and Bechelet (2009) who advocate the “Performance Measurement and Development” system developed by the Sports Turf Research Institute (STRI) but this does not measure inputs or attempt to align quality measures to resource management. Further the parameters of “quality” are not “universally” agreed. Some current performance tests require equipment not available commercially (e.g. The STRI Trueness Meter™). Performance measures or standards for other areas of the course have not been developed or implemented to any known extent. Aspects of quality from a player’s viewpoint can be qualitative and difficult to assess or measure objectively.

Golf course playing surfaces need resource inputs to maintain them as they are, largely, man-made surfaces and not wholly natural although they are made up from naturally occurring materials such as soils, sands and grasses. Another major question, directly relevant to the three case scenarios for Golf 2030, is what level of input is required to achieve optimal quality surface provision in the GC2030 context of a changing course management landscape. It may be that quality can be achieved with lower resource inputs but this needs research to inform objective assessment and measurement. Such measurements can be benchmarked for different golf greens on a given golf course and with other golf courses. Benchmarking can inform management for decision making and resource utilisation for more effective management (IOG, undated, p4). If golf course managers can achieve quality surfaces with reduced inputs (including labour, materials and chemicals) this will have positive benefits for both environment and golf club finances. Reducing inputs, however, may affect playing quality and compromise the very essence of the golf course function. Reducing golf course quality and playability may have a detrimental impact on player satisfaction and ultimately revenues as golfers elect to play elsewhere. The key question is how can we satisfy golfers’ expectation/requirements at a level which is economically and environmentally sustainable? There is also a question of performance management here and that of providing a quality product at an affordable price for the customer.
The development of a performance management framework, incorporating agreed quality standards for golf courses, for assessing maintenance inputs, costs and playing quality will potentially allow us to determine what level of management efficacy managers are achieving. Defining actual performance standards or measures for operations outputs, in this case golf course condition and playability, will complete a framework focused on the key operations drivers of reducing input costs, eliminating waste in operations and maintaining output quality.

Golf courses have to adapt to ever changing demands from the golfer, climate change and environmental regulations. Golfers demand exceptional playing surfaces all year round, and this will influence the management decisions that are made (Windows, 2005). Not all golfers’ demands are agronomically sound however, their demand for green colour and fast ball speeds have eliminated most of the fine grasses on golf greens in the UK (Isaac, 2005). A balance is needed as ignoring golfers’ wishes is economically unsustainable as most golf clubs need members to survive (England Golf, 2014). Meeting these demands can also be hindered, however, by budget constraints, increasingly stricter regulations on water and pesticide use and problematic weather conditions (Windows, 2005). Any model that serves to optimise such parameters must do so in a way which informs effective management decision making.

The industry lead initiatives identified in this report are seen as key to achieving the outcomes for Golf 2030 and sustaining golf in the future in respect of all three stated scenarios.

7. ACKNOWLEDGMENTS

We would like to pass our thanks to the following organisations who helped with the production of this action plan:

British and International Golf Greenkeepers’ Association (BIGGA)
British Agrochemical Standards Inspection Scheme (BASIS)
Club Managers Association of Europe (CMAE)
European Institute of Golf Course Architects (EIGCA)
England Golf
European Tour
Golf Club Managers Association (GCMA)
Golf Course Superintendents Association of Ireland (GCSAI)
Golfing Union of Ireland (GUI)
Golf Foundation
Ladies European Tour (LET)
Professional Golfers Association (PGA)
Scottish Golf
Sports Turf Research Institute (STRI)
Register of Independent Professional Turfgrass Agronomists (RIPTA)
Wales Golf

8. REFERENCES

Institute of Groundsmanship, (Date Unknown). An Introduction to IOG Performance Quality Standards. Milton Keynes, UK: IOG
Isaac, S., 2008. The Human Side of Turfgrass Management: Putting into human terms important aspects of golf course turf management. USGA Green Section Record, July-August Issue
APPENDIX 1. Characteristics of Good Playing Surfaces for Golf (Hayes, 1990)

<table>
<thead>
<tr>
<th>Surface</th>
<th>Quality component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greens</td>
<td>Fast, true, firm surfaces</td>
</tr>
<tr>
<td></td>
<td>Uniform grass cover</td>
</tr>
<tr>
<td></td>
<td>Dry surfaces</td>
</tr>
<tr>
<td></td>
<td>Suitability for year-round play</td>
</tr>
<tr>
<td>Approaches and surrounds</td>
<td>Dry surfaces</td>
</tr>
<tr>
<td></td>
<td>Freedom from wear patterns</td>
</tr>
<tr>
<td></td>
<td>Good cover of grass</td>
</tr>
<tr>
<td>Tees</td>
<td>Large, level, firm, dry surfaces</td>
</tr>
<tr>
<td></td>
<td>No wear pattern on and off tees</td>
</tr>
<tr>
<td></td>
<td>Uniform grass cover</td>
</tr>
<tr>
<td>Fairways</td>
<td>Free drainage</td>
</tr>
<tr>
<td></td>
<td>Suitability for year-round play</td>
</tr>
<tr>
<td></td>
<td>Good cover of grass</td>
</tr>
<tr>
<td></td>
<td>Lies uniform</td>
</tr>
</tbody>
</table>
## APPENDIX 2. Golf Course Condition and Playability – Existing Playing Surface Quality Assessments

<table>
<thead>
<tr>
<th>Area</th>
<th>Quality</th>
<th>Method</th>
<th>Measurement/Target range</th>
<th>Source</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golf Greens</td>
<td>Speed</td>
<td>Stimpmeter</td>
<td>Ball roll distance in feet and inches 4’6”-8’6” – Regular Play 6’6”-10’6” – Tournament Play</td>
<td>USGA</td>
<td>Widely used especially for tournaments</td>
</tr>
<tr>
<td>Trueness/Smoothness</td>
<td>STRI Trueness Meter™</td>
<td>Visual assessment</td>
<td>Vertical/Lateral Ball deviation in mm/m 25mm/m smoothness 10mm/m trueness Smoothness Scale (1-10)</td>
<td>STRI</td>
<td>STRI Patented Equipment (not available for commercial use)</td>
</tr>
<tr>
<td>Consistency</td>
<td>Holing Out Test</td>
<td></td>
<td>Ball Roll (Putts) from 3,6 and 9ft. Measured from 10 rolls. Aim 10/10 score from each distance</td>
<td>The R&amp;A/Greenstester</td>
<td>‘Greenstester’ ramp preferred Easy to use. Not in wide use. Can assess Green Speed too. A cheaper alternative to STRI Trueness Meter?</td>
</tr>
<tr>
<td>Firmness</td>
<td>Clegg Firmness Scale (Gravities)</td>
<td>TruFirm - measures surface penetration</td>
<td>Scale usually &lt;60 – 130 Parkland target = 80-100 Links target = 100-130 Range - 0.1 in - 1.5 in depth</td>
<td>STRI/USGA/Spectrum Technologies (Field scout)</td>
<td>Clegg Hammers are widely used in GB&amp;I US Method. Not widely used in UK.</td>
</tr>
<tr>
<td>Thatch</td>
<td>Organic matter content as a % of soil/rootzone</td>
<td></td>
<td>Typically &lt;4% specified 3-8 mm depth</td>
<td>STRI/IOG</td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>Theta Probe/Volumetric</td>
<td></td>
<td>Typically &lt;15-30% specified</td>
<td>STRI</td>
<td></td>
</tr>
</tbody>
</table>
| Drainage | Infiltrometer | 1.2cm/hr to 1.8cm/hr  
Up to 2.5cm/hr for high sand content greens | IOG | Water Infiltration and other rootzone properties for greens are further specified in construction recommendations such as the USGA method. |
| Rooting Depth | Core samples measurement | Min 75mm | IOG |
| Sward composition | Quadrat Surveys/Observation | Minimum cover -99.5%  
Fine Grasses Min-80%  
Poa content -Max-20% | IOG |
<p>| Weed/Moss Content | Quadrat Surveys/Observation | &lt;4% of cover | IOG |
| Disease ingress | Quadrat Surveys/Observation | &lt;2% of cover | IOG |
| Sward Colour | Colour charts | Uniform ‘medium to dark’ green | IOG | A subjective trait. Chlorophyll meters are available and can be used in assessment of turf ‘health’. |
| Tees | Surveying Equipment | Max. Fall-1:100 to flat | IOG |
| Surface Evenness | 0.5m straight edge | Max. ± 6mm | IOG |
| Thatch | Organic matter content | Range 3-12 mm depth | IOG |
| Rooting Depth | Core samples measurement | Min. 75mm | IOG |
| Drainage | Infiltrometer | 1.2cm/hr | IOG |</p>
<table>
<thead>
<tr>
<th>Sward composition</th>
<th>Quadrat Surveys/Observation</th>
<th>Minimum cover -60-80 % Desirable Grasses Min-80% Poa content –Max-20%</th>
<th>IOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed/Moss Content</td>
<td>Quadrat Surveys/Observation</td>
<td>&lt;5% of cover</td>
<td>IOG</td>
</tr>
<tr>
<td>Disease ingress</td>
<td>Quadrat Surveys/Observation</td>
<td>&lt;5% of cover</td>
<td>IOG</td>
</tr>
<tr>
<td>Sward Colour</td>
<td>Colour charts</td>
<td>Uniform ‘medium to dark’ green</td>
<td>IOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fairways</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thatch</td>
<td>Organic matter content</td>
<td>Range 3-15 mm depth</td>
<td>IOG</td>
</tr>
<tr>
<td>Rooting Depth</td>
<td>Core samples measurement</td>
<td>Min. 75mm</td>
<td>IOG</td>
</tr>
<tr>
<td>Drainage</td>
<td>Infiltrometer</td>
<td>1 cm/hr</td>
<td>IOG</td>
</tr>
<tr>
<td>Sward composition</td>
<td>Quadrat Surveys/Observation</td>
<td>Minimum cover -95 % Desirable Grasses Min-80% Poa content –Max-20%</td>
<td>IOG</td>
</tr>
<tr>
<td>Weed/Moss Content</td>
<td>Quadrat Surveys/Observation</td>
<td>&lt;10% of cover</td>
<td>IOG</td>
</tr>
<tr>
<td>Disease ingress</td>
<td>Quadrat Surveys/Observation</td>
<td>&lt;5% of cover</td>
<td>IOG</td>
</tr>
<tr>
<td>Sward Colour</td>
<td>Colour charts</td>
<td>Uniform ‘medium’ green</td>
<td>IOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-Rough/Rough</td>
<td>Rooting Depth</td>
<td>Min. 75mm</td>
<td>IOG</td>
</tr>
</tbody>
</table>

A subjective trait. Chlorophyll meters are available and can be used in assessment of turf ‘health’
<table>
<thead>
<tr>
<th></th>
<th>Method</th>
<th>Specification</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage</td>
<td>Infiltrometer</td>
<td>0.5 cm/hr</td>
<td>IOG</td>
</tr>
<tr>
<td>Sward composition</td>
<td>Quadrat Surveys/ Observation</td>
<td>Minimum cover -80% Desirable Grasses Min-70%</td>
<td>IOG</td>
</tr>
<tr>
<td>Weed/Moss Content</td>
<td>Quadrat Surveys/ Observation</td>
<td>Max. 10-20% of cover</td>
<td>IOG</td>
</tr>
<tr>
<td>Bunkers</td>
<td>Depth of Sand Ruler/Depth/Auger</td>
<td>Min.100mm at base 50mm at face</td>
<td>IOG</td>
</tr>
<tr>
<td>Sand particle size</td>
<td>Particle analysis (sieves)</td>
<td>Majority of particles to be within 0.125-1.00mm range.</td>
<td>IOG Sub-angular shaped particles preferred for stacking at bunker face.</td>
</tr>
</tbody>
</table>
**APPENDIX 3. Golf Course 2030 Scenarios**

**Scenario 1.** Limited change from the environment that now exists as alternative technologies, management solutions and behavioural change address the challenges posed by climate, resources and regulations and optimal golf course condition and playability is secured.

**Scenario 2.** Severe restrictions in the availability and use of synthetic chemical plant protection products, together with 50% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change partially address the challenges posed by climate, resources and regulations.

**Scenario 3.** The banning of all chemical plant protection products and fertilisers, together with 75% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change fail to address the challenges posed by climate, resources and regulations.
### APPENDIX 4. Proposed Draft Framework Performance Management

<table>
<thead>
<tr>
<th></th>
<th>Description of Facility</th>
<th>Characteristics &amp; Target Market</th>
<th>Expected Standard</th>
<th>Support &amp; Guidance to develop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Elite Venues</strong></td>
<td>Price point ≈ £150 + Social group ≈ A/International Planning &amp; Strategic Planning</td>
<td>95% achievement of performance criteria</td>
<td>Policy Formulation &amp; Strategic Planning</td>
</tr>
<tr>
<td></td>
<td>Open championship venues Prestige golf clubs</td>
<td>Tourism/affluent members</td>
<td></td>
<td>International Marketing</td>
</tr>
<tr>
<td>2</td>
<td><strong>Private Members Clubs</strong></td>
<td>Price point ≈ £70 Social group ≈ A/B Marketing</td>
<td>90% achievement of performance criteria</td>
<td>Policy Formulation &amp; Strategic Planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social group ≈ A/B Tourism/affluent members</td>
<td></td>
<td>Marketing</td>
</tr>
<tr>
<td>3</td>
<td><strong>Private Members Clubs</strong></td>
<td>Price point ≈ £40 Social group ≈ B Resources Procurement</td>
<td>80% achievement of performance criteria</td>
<td>Operational Performance &amp; Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social group ≈ B Members clubs</td>
<td></td>
<td>Resource Procurement</td>
</tr>
<tr>
<td>4</td>
<td><strong>Corporate Clubs</strong></td>
<td>Price point ≈ £25 Social group ≈ C1/C2 Greenkeeping practice guidance</td>
<td>70% achievement of performance criteria</td>
<td>Formal training of staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Corporate clubs</td>
<td></td>
<td>Greenkeeping practice guidance</td>
</tr>
<tr>
<td>5</td>
<td><strong>Municipal Clubs</strong></td>
<td>Price point ≈ £15 – Social group ≈ D/E Resource inventory</td>
<td>60% achievement of performance criteria</td>
<td>Formal training of staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social group ≈ D/E Casual golfers</td>
<td></td>
<td>Greenkeeping practice guidance</td>
</tr>
</tbody>
</table>

Performance management framework can be used to support course managers and green keepers. Golf courses are arranged as to the type of venue, with corresponding expected standards, support, and guidance.