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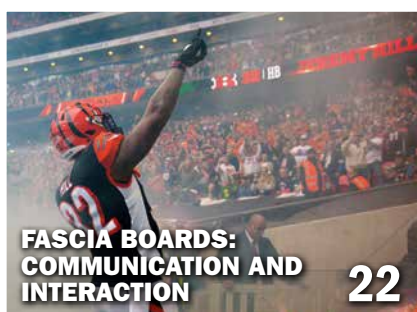
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Stadionwelt INSIDE – the expert
magazine for the business

INDUSTRY REPORT: LED DISPLAYS

When it comes to **video walls** and **video cubes**, they will inevitably be produced by Chinese manufacturers. Specific expertise and services are required for consultation and installation in sports facilities. This is where **European companies demonstrate their special know-how and quality of service**, as interface between the global market and local requirement profiles.

During the past few years, the area per stadium, just like the pixel resolution of the devices, has increased considerably in the course of ongoing new installations – within the scope of possibilities which the cramped football stadiums allow. But in comparison: in the new Tottenham Hotspur stadium in London alone, US market leader Daktronics has installed video displays covering an area of 1,030 m². Several hundred displays covering up to more than 1,000 m² per installation is now more or less standard in the USA.

This does not yet depict the role that the sports sector of the LED industry in Europe plays in a global context. But the trend is plain to see. And if you look beyond the sports sector, it also looks pretty much the same in our part of the world. Huge digital advertising screens and info boards, such as those which dominate the look of whole city districts in Asia and the USA, are hardly to be seen here. Other conventions and viewing habits constitute some of the reasons for this. In Germany the advertising industry can consider itself lucky to be allowed to install 5 m² displays in public places from time to time.

Europe is not the hub of the world for LED manufacturers. The sports stadium niche market can indeed be prestigious if you are involved in lighthouse projects. However, market volume is limited when viewed in global proportions.

CHINA SETS THE PACE

The heart of the LED industry and one of the world's high tech centres is the "boom town" and special economic zone Shenzhen in South China, located in close prox-

imity to Hong Kong, with 12 million inhabitants. A large proportion of the global production of LED components is located here, along with the companies specialised in visual media. So it almost goes without saying that the bulk of this production has its most important market on the doorstep, and companies thus align themselves accordingly. But almost the whole production of LED displays used in Europe is located here too. This means that European suppliers are practically obliged to maintain a presence in Shenzhen in one way or another.

By all accounts, European engineers have a good reputation here, and their opinions are valued when it comes to innovations and optimisations. Thus one of the advantages of having access to the Chinese production plants is also already being able to get a glimpse of prototypes and new devices which are not yet on the market.

Nevertheless, we have to get rid of the preconception of sub-standard imported goods. Those who know the local industry emphasise that you can get just about everything in Shenzhen – from distinctly dubious mass-produced goods, via dependable medium quality products up to genuine top class products from select production workshops. And all these to respectively fair prices. But even recognised LED experts can lose their bearings in the bustle of Shenzhen – both geographically and technically. Because you cannot tell right away if any of the products come up to the expected quality standards. This often only becomes apparent when you open the rear side or after many hours of operation.

To create a favourable bargaining position, it is best to purchase the largest possible quantities, which can become a

challenge in view of the comparatively small areas required in sports installations and rental applications. Thus the best approach is often to adopt group buying, whereby for example a company can purchase enough to supply one of its major projects, and sell on the remainder to strategic purchasing partners at accordingly lower prices.

WHO IS WHO?

For the end customer, which company makes the product is not of crucial importance, as long as experts in the field with specific know-how recommend it for this application and guarantee its suitability. It is always possible and common to the market that production batches can differ with regard to various specifications; it is also possible and in no way a negative factor that identical modules are sold under different brand and manufacturer names.

Some of these product configurations are the result of strategic partnerships. Because the manufacturers generally confine themselves to producing the LED modules, a lot of requirements have to be met on the journey to the video wall, video cube or ribbon display end product and to finally putting it into operation. These can sometimes be clearly defined with the help of specialised partners or acquisitions and implemented to suit the customer. This is how the German company Ledcon develops, produces and installs in collaboration with the Chinese global player Unilumin. ROE is also part of the Unilumin Group. NEC Display Solutions Europe on the other hand, a subsidiary of the global company NEC with its origins in Japan, took over the German system integrator and LED manufacturer S[quadrat] as of 01/04/2018. In this way both companies can enhance their market position and expand their product portfolio.

In Germany in particular, where installation of the second generation of video walls has gradually been underway since the stadiums were opened in the 2000s, it can be seen that although major corporations characterised by

consumer orientation carried out the initial installations, they are not making their presence felt during the renewal of the existing equipment. Philips, Mitsubishi, Toshiba, Panasonic – brands such as these only still seem to be involved, at least this is the current impression, in the case of lighthouse projects which can highlight the brand as a whole. At Philips the product line seems to have slipped



Picture: STADIUMWORLD

through the net during restructuring of the group, while LED lighting has a prominent place (now independently marketed as Signify).

The low order volume in a niche market, along with the price structure and the very special pattern of the industry environment means that medium-sized companies and even individuals in key positions can take advantage of their strengths, while the major players of the electronics industry hold themselves back.

SPORTS FACILITIES: A SPECIAL AREA

The sports sector differs little from other areas of application for LED displays in terms of technology, but more in the sales process, because the contact people are in a different environment, and other practices prevail. In new construction pro- ➔

jects the construction company generally issues the tender – a comparatively emotion-free impersonal procedure. A few years ago local authorities or civic planners were the contact persons for the industry. This sales channel is meanwhile almost redundant and has been outsourced to specialist companies. In the case of new installations in existing buildings the club is usually the contact person, and wants a new version of what they have already been using for a long time, or an extension of the building is to be considered. The investment cycle for LED displays is around 10 years. During this period the pixel pitch, taking a central characteristic value of 20–25 mm, has in the meantime virtually decreased to 10 or even 6 mm SMD. For the retrofitting of the 2nd generation, all operators have more comparison and empirical data than they had for the initial installation. And envy swiftly comes into play when other clubs show off their new installation. The fact that values are attained in terms of pixel pitch, luminosity and other parameters that bear hardly any relation to actual practice is an aspect that draws criticism from experts. But sports installations have also become more sophisticated due to the feed technology. HD is now standard, and sponsors and their agencies provide almost exclusively HD material these days which is scaled on the respective display accordingly. For this reason 10 mm SMD technology has become the current standard for the displays. But an operator can also be forced to retrofit when spare parts are no longer available for existing equipment, and/or when the manufacturer is no longer in the market.

In any case – for customers in the sports segment, the starting point is always somewhat more individual than in other segments. In Europe only a very modest number of sales representatives have contact with the decision makers in clubs, stadiums and arenas. Much of what goes on here depends on networking and personal contacts. If you can

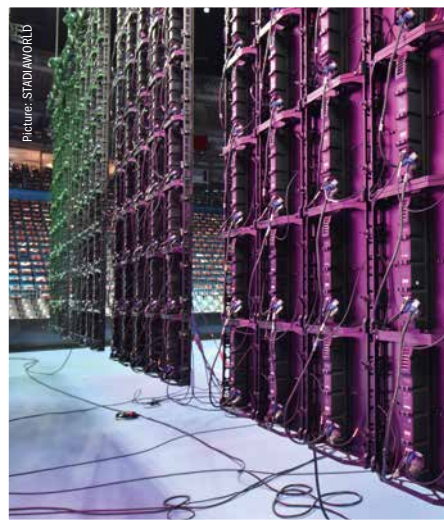
provide good references, you will quickly get the attention of good customers. Thus the reference list shows that the majority of current projects are in the hands of a small number of regional providers. In many cases only the manufacturer or specialist planner are listed, while teams of experts work behind the scenes, taking care of their respective areas of expertise. The fact that specific know-how is required for a manufacturer to enter this market is because every new stadium is a specially designed building. Potential major providers are unable to barge their way onto the market

with just one standard solution and thus achieve their market shares.

Roger Rinke, CEO of AV consultants and specialist planners Screen Visions, explains: “Contracts in this sector have no uniform structure. The parameters are different for every project. Customer requirements are also always different. Some have personnel structures that enable them to implement projects like this themselves, others rely more on consultants. The market is very diverse, so that there is a huge range of service concepts.” However, Rinke describes the number of competent

specialist planners in the professional arena and stadium sector as being “a handful”.

The control system for the displays runs around the building via long cabling routes, and the overall signal management can be a very specialised task. Because the video wall is no longer just a big television with a scoreboard. It has become a central component of a stadium TV system for the whole complex. The more professionalised and commercialised a club and its facilities have become, the more complicated the system. In contrast to advertising displays, which are only noticed briefly by passers-by, the video walls are at the centre of attention in stadiums, nowadays as part of an integrated audio-visual concept.



RUINOUS BUSINESS MODEL?

Accordingly negotiation has to be carried out differently from the start than in the past few years. Often large scale investment is already demanded in the tender procedure. If you get involved in this market segment, a high level of personal commitment and flexibility is essential. Planning, installation, steel construction, to name just a few aspects: sports facility projects can become very complex, and are thus a segment of their own with their own rules. Because some of the market leaders among the sports clubs dictate these rules themselves, even large companies in the respective group of bidders pull out. One type of pricing can be linked to the sponsoring; if corporations want to use a project to enhance their image, it is sometimes taken into account that the contract itself can hardly be fulfilled so that costs are covered. Some of the mid-sized specialist companies no longer wish to go down that road, and focus rather on profitable projects. Another argument is that only awarding contracts using the criterion of the lowest price contradicts the concept of quality that many AV experts who develop complex stadium solutions adhere to.

The introduction of LED ribbon displays, which are now already standard at least for TV marketing in the front row around the playing field, might at first have seemed promising for many suppliers. However, in practice the trend swiftly developed towards leading professional sports marketing companies purchasing directly from source and renewing their stock regularly. This concerns a significant order volume, although there is no longer an open market. There may still be a certain variety in some handball and basketball arenas. But where competition arises, even proven LED experts can no longer keep up. Meanwhile professional equipment for a football match day in a rental package with about 246 linear metres of ribbons including logistics, service and manpower costs less than 10,000 euros. It would be simply ruinous for every normal rental company to enter the bidding.

In the meantime the LED boom around the playing fields has not led to an overall fall in prices. All types of product in all quality and price categories are still on offer, although the average cost has stayed at 2,500 euros/m², which covers just the LED module itself – not including steel construction, installation etc. So this is about newer technology at the old price, while the old technology is no longer produced and is gradually disappearing.

So when it comes to video walls of all sizes or to video cubes or ribbon displays for large arenas, which on the other hand represent a special segment, the orders at first concern only the “screen” as such, including of course chassis and mounting. On the rear side, differing little from the domestic television, there is a DVI socket. From this point on the management is responsible, or rather other service providers are assigned further orders.

While a few years ago PCs and video recorders were still used as playback devices, the scenario has been catapulted into broadcast quality within one generation of devices. Nowadays clubs make their own professional productions or assign service providers. In the course of the merging of IT and video technology, top quality is meanwhile available at low prices, so that everyone can afford high end results are attainable for everyone.

In business practice however, and it has been possible to collect these empirical data from every source during the past 20 years, a project is actually completed when the video wall has been installed and approved. Consultation and sometimes also active support continue to be needed during the years that follow. What already begins before specific projects as networking, personal acquaintance, information exchange and also intensive consultation is then continued in a relationship of trust. And it is precisely at this interface that mid-sized specialist companies play off their strengths and position themselves in both the global and local LED market activities.

The service concept has become even more deeply rooted. A video wall operator needs a personal contact, who can be there when required, to solve both small and large problems. It can involve maintenance, genuine emergencies or even a larger package entitled “After Sales Service”. German providers in Europe have earned themselves an excellent reputation in the course of fulfilling all kinds of tasks from development, planning and installation through to actual operation. With a sturdy workforce comprising engineers and qualified technicians, a company can act as LED partner throughout the lifecycle of a system.

Global players such as Absen and Unilumin are hardly in a position to fulfil such a role with a strong presence on site – while in many situations European partners can be an ideal auxiliary. ◆



PROFESSIONAL LED-DISPLAYS for professional requirements

Whether LED video cubes, LED perimeter systems, LED displays for conferencing, Digital Signage, DooH as well as individual custom made screens: We offer our customers a comprehensive all-inclusive service using the latest LED technology. Forward-looking, strong and efficient. Let our LEDCON specialists advise you and rely on the technology of the market leader of LEDCON Systems GmbH.

As a manufacturer of high quality LED displays and integrated concepts from one single source the satisfaction of our customers has the highest priority.

It is important for LEDCON Systems to stay in close contact with the client, even after finishing a project instead of leaving him alone with only the product. Maintenance, service contracts and the service-hotline are among others the key facts, that have given LEDCON a unique position in the market.

Our LEDCON sales & project managers and our LEDCON support provide you with a maximum of expertise, experience and commitment. We always have the latest market developments in mind to pass this technology directly to our customers. Our range of service includes not only the simple selling of LED displays. LEDCON Systems is advising customers and prospects from the idea to the implementation and beyond it.

UNIQUE services

Professional consulting around LED displays

Planning with 3D software of our IT specialists

Cooperation with reliable local partners for construction/metal-work

Multi Content Solutions

Large product portfolio

IT solutions for software needs

Custom-made products

Reparation service / sales representatives

In-house & on-site repair → Professional, quick and qualified

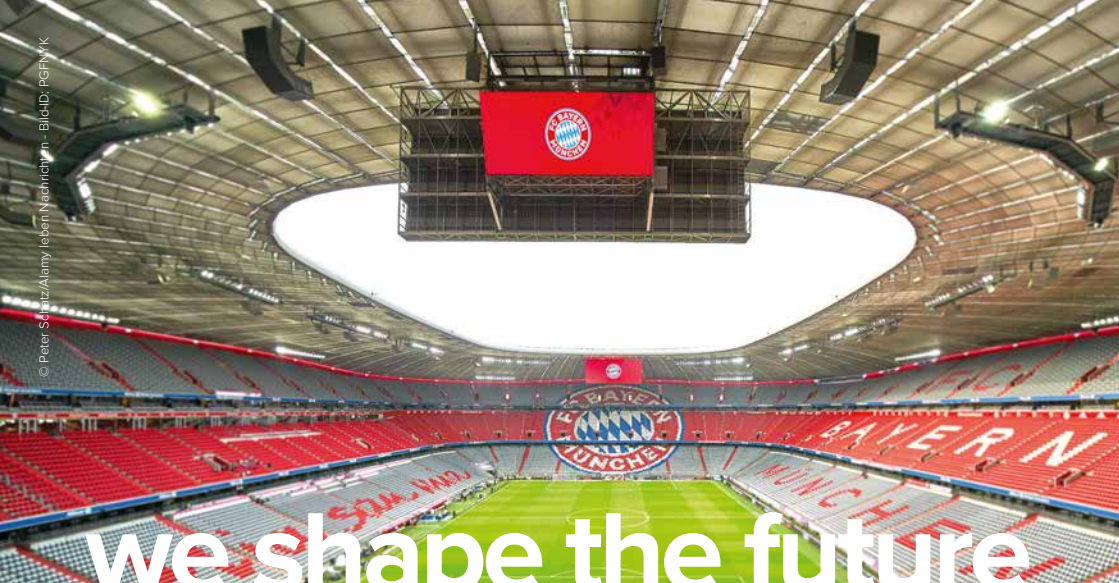
Original spare parts → Immediate supply of spare parts

Maintenance → Avoid malfunction or failure

Remote maintenance → Technical online-support

Technical support → Competent and professional assistance through professionals

Service-contracts → Maintenance agreements for 2 years and more

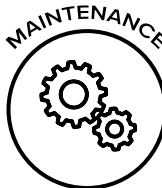
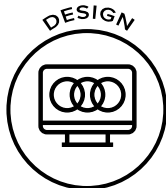
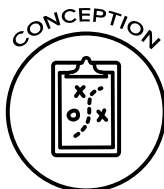
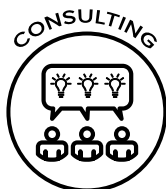


We shape the future

LED-DISPLAY TURNKEY SOLUTIONS

For more than 15 years of company history LEDCON Systems focuses on offering and executing well-rounded projects.

As a manufacturer of high-quality LED-Displays and integrated concepts from one source, LEDCON Systems top priority is customer satisfaction.



BIGGER, BETTER, BRIGHTER!

The **quality of LED displays** in stadiums and arenas is continually improving. **Advances in the construction** are also making it possible to present **spectacular designs and superlative graphics**.

The past years have seen quite a large number of stadiums and indoor arenas being built around the world that are shining examples of outstanding architecture. Nowadays, however, the technical equipment also provides several features in special venues which also enthrall spectators, and remain alive in everyone's memory. For instance, the video displays in stadiums are continuing to get bigger and better. Because LED modules have become slimmer, more flexible, more economical and brighter, their design can have a decisive effect on the visual impact of the stadium – from the facade to the interior – and sometimes also blend into the building itself.

um – from the facade to the interior – and sometimes also blend into the building itself.

In the USA, the Mercedes-Benz Stadium in Atlanta was a groundbreaking project, with 16 LED displays covering a total area of 7,757 m², including the innovative halo display on the roof construction. But there was also the U.S. Bank Stadium in Minneapolis, and multi-function arenas such as Little Caesars Arena (Detroit) and the Golden 1 Center (Sacramento) – to name but a few.

VIDEO DISPLAYS: LARGE ARENA INSTALLATIONS (SELECTION)								
Type	Country	City	Venue	Main tenant	Display	Installation year	Producer	Size (in m ²)
A	CAN	Edmonton	Rogers Place	Edmonton Oilers	1 video cube	2016	Prismview	616
A	GER	Berlin	Mercedes-Benz Arena	ALBA Berlin/Eisbären	1 video cube	2017	Gahrens + Battermann	124
A	GER	Cologne	LANXESS arena	Kölner Haie	1 video cube	2019	Expromo	144
A	KAZ	Almaty	Halyk Arena	Winter-Universiade 2017	1 video cube	2016	Colosseo	107
A	RUS	Chelyabinsk	Traktor Ice Arena	HC Traktor Chelyabinsk	1 video cube	2017	Colosseo	140
A	RUS	Magnitogorsk	Arena Metallurg	HK Metallurg Magnitogorsk	1 video cube	2016	Colosseo	100
A	USA	Chicago	United Center	Chicago Bulls/Chicago Blackhawks	1 video cube	2019	Mitsubishi	805
A	USA	Cincinnati	Fifth Third Arena	University of Cincinnati	1 video cube	2018	Daktronics	186
A	USA	Detroit	Little Caesars Arena	Red Wings/Pistons	1 video cube	2017	Daktronics	474
A	USA	Elon	Schar Center	Elon University	2 video boards	2018	Daktronics	162
A	USA	Lexington	Rupp Arena	Kentucky Wildcats	1 video cube	2016	Daktronics	290
A	USA	Newark	Prudential Center	New Jersey Devils	1 video cube	2016	Absen/Trans-Lux	887
A	USA	Philadelphia	Wells Fargo Center	Philadelphia Flyers/Philadelphia 76ers	1 video cube	2019	ANC	613
A	USA	Raleigh	PNC Arena	Carolina Hurricanes	1 video cube	2019	Daktronics	860
A	USA	Sacramento	Golden 1 Center	Sacramento Kings	1 video cube	2016	Panasonic	567

Type of Sports Venue: A = Multifunctional Arena

Source: STADIAWORLD

As well as in the USA, several significant projects for video displays were also completed recently in stadiums in Russia. However, the series of stadium sensations slowed down somewhat since 2018. Nevertheless: the last two years some interesting projects were implemented. But their significance cannot only be measured by the sheer area of displays, as demonstrated by the Olympiastadion Berlin. The upgrading of the displays 2018 in Berlin was one of the biggest challenges for the Olympiastadion Berlin. As a protected historical building, this stadium is subject to particularly strict and wide-ranging restrictions regarding all installation and conversion measures, which means that a new support frame cannot simply be suspended beneath the roof structure, which is the normal procedure elsewhere. In collaboration with the company Expromo the stadium in Berlin has invested in its technical equipment. Within two weeks the existing video screens were modernized and a third screen was installed on the south side.

In the USA, Daktronics is the leading provider of sports facility LED display installation services, and the US company continually earns itself a place in the ranking lists every year with a whole series of projects. The systems are often first put into operation at the start of the season in September, which is also when the NFL starts. In 2017, Daktronics equipped nine

sports facilities with a total of 74 LED screens, representing a total area of 129,000 m². But with the opening of the Tottenham Hotspur's new White Hart Lane in London in April 2019 the US company is also represented in Europe with a prestigious project. Two large display boards measuring over 1,000 m², two facade displays and three LED ribbon displays were installed. The two display boards on the "home end" southern stand each measure 325 m², and each of the display boards on the northern stand 190.7 m². Two additional displays in the southwest and southeast sectors each measure 178.9 m². The installation of three revolving LED ribbon displays is a first in the UK.

The Centennial Authority, owner of the PNC Arena situated in Raleigh, and – once more – Daktronics are partnering to add 372 m² to the existing 488 m² centerhung LED display system by the start of the 2019/20 hockey season of the Carolina Hurricanes, NC State University men's basketball games and other special events held at the facility. The board is curved around the corners to provide a large, single canvas presentation that is HDR ready and capable. Two displays will be mounted to the underbelly of the centerhung to appeal to fans, players and coaches sitting court-side. Each display will measure approximately 3 m high by 6 m wide and will feature 3.9-mm line spacing to provide optimised resolution for those viewers. ♦

VIDEO DISPLAYS: LARGE STADIUM INSTALLATIONS (SELECTION)

Type	Country	City	Venue	Main tenant	Display	Installation year	Producer	Size (in m ²)
S	ENG	London	London Stadium	West Ham United	1 video board	2016	Daktronics	1,129
S	ENG	London	New White Hart Lane	Tottenham Hotspur	2 video boards	2018	Daktronics	1,031
S	ESP	Madrid	Wanda Metropolitano	Atlético de Madrid	3 video boards	2017	LG	224
S	GER	Berlin	Olympiastadion Berlin	Hertha BSC	3 video boards	2018	Expromo	301
SR	GER	Gelsenkirchen	VELTINS-Arena	FC Schalke 04	1 video cube	2016	Hisense	304
S	GER	Munich	Allianz Arena	FC Bayern München	4 video boards	2017	LEDCON	480
S	RUS	Krasnodar	Krasnodar Stadium	FC Krasnodar	360° video board	2016	Unilumin	4,700
S	RUS	St. Petersburg	Gazprom Arena	FK Zenit	2 video boards	2017	Colosseo	630
SR	USA	Atlanta	Mercedes-Benz Stadium	Atlanta Falcons	360° Halo Board	2017	Daktronics	5,927
S	USA	Auburn	Jordan-Hare Stadium	Auburn Tigers	1 video board	2015	Daktronics	1,006
S	USA	Baltimore	M&T Bank Stadium	Baltimore Ravens	2 video boards	2017	Daktronics	1,338
S	USA	Chicago	U.S. Cellular Field	Chicago White Sox	3 video displays	2016	Mitsubishi	1,171
S	USA	Cleveland	Progressive Field	Cleveland Indians	1 video board	2016	Daktronics	1,206
S	USA	Houston	NRG Stadium	Houston Texans	2 video displays	2013	Mitsubishi	1,352
S	USA	Jacksonville	TIAA Bank Field	Jacksonville Jaguars	2 video boards	2014	Daktronics	2,018

Type of Sports Venue: S = Stadium, SR = Stadium with retractable roof

Source: STADIAWORLD

MEDIA FAÇADES: BRINGING BUILDINGS TO LIFE

Because sport and entertainment venues base their whole concept on bringing as many people as possible close to what is happening in the action zone inside the venue, and the viewing direction is focused on this, they turn their back on the world outside. This means that the negative aspects of the concrete step elements, and in closed arenas the bare outer walls, dominate the optical aspect. Inviting and representative gateway situations have certainly always been created – but without projecting the lively interior of an arena outwards.

But around the globe media façades are attracting more and more attention. They are becoming an integral part of the architecture and also giving the building with its content a vibrant feeling. The basic option of this type of façade design gets its effect primarily from pre-configured light effects with LED installations and/or additional illumination as well as projection parts.

The probably largest façade of this type in the world on a stadium can be found at FC Bayern München's Allianz Arena. One of the currently largest multifunctional media façades fitted on a

stadium adorns the Corinthians Arena in São Paulo, Brazil. The LED system with measurements of 170 x 20 m enables with its 34,000 LED light spots or 1,320 LED diodes reproduction of types of visual media.

The outer side of the façade construction of the National Gymnastics Arena in Baku is surrounded by a flap construction that can control the supply of daylight as well as the solar yield. A dynamic light solution illuminates the transparent outside of the arena and provides for an array of colour combinations. The transparent screens that are fitted around the façade not only offer stability but also ensure an unrestricted view outside whilst videos are played.

The 360° multimedia façade of the stadium San Mamés shapes the cityscape of Bilbao since 2014. It is fitted with five horizontal rings with 500 vertical sails that are 5 metres high. For the illumination in total 42,500 RGB dots have been installed. In order to communicate atmosphere and emotions over the façade different dynamic light sequences will be used which can also display graphics and text with low resolution.

With 5,200 m² the Tauron Arena in Krakow, Poland has Europe's largest media façade on an indoor venue. The LED bands running around the arena can play all content that the arena wants to show.

Among the indoor arenas, the T-Mobile Arena in Las Vegas was one that recently drew attention, and likewise the Wanda Metropolitano, which is home to Atlético Madrid, was one of the stadiums to draw attention, after Bilbao and Seville in Spain had already turned on their lights. Certainly Real Madrid strive to surpass the competitors with the upcoming rebuild of the Estadio Santiago Bernabéu and the FC Barcelona shall try to be yet a little bit more spectacular with its new façade. ◆



STADIUMS AND ARENAS WITH ILLUMINATED BUILDING ENVELOPES AND MEDIA FAÇADES (SELECTION)

Country	City	Stadium/Arena	Description	Year	Supplier
Azerbaijan	Baku	National Gymnastics Arena	Membrane sails have been attached to the multi-function arena's façade, which can control both the amount of daylight and the solar yield. Behind this is a dynamic light solution comprising 10 transparent screens for graphic effects.	2015	Traxon
Azerbaijan	Baku	National Stadium	The lightweight steel/membrane façade can be brought to life with dynamic lighting effects.	2015	Traxon
Brazil	Rio de Janeiro	Maracanã	During its renovation before the 2014 World Cup, the legendary stadium was equipped with an LED façade lighting system.	2014	Schröder
Brazil	São Paulo	Corinthians Arena	On the outer façade there is an LED panel measuring 170m x 20m, which is recessed in glass panels.	2014	Traxon
China	Shaoxing	Lotus Stadium	The PTFE façade is illuminated in various colours by linear LED lights.	2014	Strong LED
China	Beijing	Beijing National Aquatics Centre	The "bubbles" design of the Olympic Aquatics Centre made of ETFE foil can be brought to life using the lighting system.	2008	Vector Foiltec
Germany	Berlin	Mercedes-Benz Arena	LED façade measuring 12 m x 120 m with 300,000 light points forming an illuminated grid.	2008	-
Germany	Munich	Allianz Arena	300,000 LED lights illuminate the 26,000 m ² inflatable façade in scenarios that can be configured individually. Interior fitted with LED and LED strips since 2015.	2015	Signify
France	Lille	Stade Pierre Mauroy	LED media façade measuring 20 m x 120 m with 70,000 pixels on a mesh can illuminate the stadium in the desired design.	2012	Traxon
Canada	Saskatoon	SaskTel Centre	The multi-function arena façade is illuminated with coloured floodlight. Various settings can be programmed.	2009	Lumenpulse
Canada	Vancouver	BC Place Stadium	LED architecture lighting for the building and the roof membrane, various colour settings are possible.	2011	Lumenpulse
Peru	Lima	Estadio Nacional del Perú	The façade transmits the atmosphere inside dynamically to the outside world. 1,450 LED lights are built into the façade mesh. Another 165 lights illuminate the stadium roof indirectly.	2011	Traxon
Poland	Cracow	Tauron Arena	5,100 m ² of the all-round illuminated façade serve as a video display.	2014	ColosseoEAS
Russia	Sochi	Olympic Park	Several buildings in the Olympic complex have LED façade, such as the Olympic Stadium and the Adler Arena.	2014	-
Sweden	Solna	Friends Arena	LED glow sticks on the façade mesh can create dynamic colour effects.	2012	Signify
Spain	Barcelona	Camp Nou	FC Barcelona is visualising its design for the renovated Camp Nou with lighting effects.	2022 (planned)	N.N.
Spain	Bilbao	San Mamés	2,500 sail elements surround the façade, which is illuminated in colour by 42,500 RGB dots.	2014	Traxon
Spain	Madrid	Estadio Santiago Bernabéu	360° ribbon displays integrated into the inner roof.	planned	N.N.
Spain	Seville	Estadio Ramón Sánchez Pizjuán	The old existing building takes on a new modern appearance with a new façade cladding including LED elements.	2016	Design by Santiago del Campo
USA	Las Vegas	T-Mobile Arena	The gigantic display on the semi-transparent media façade of the new arena measures over 836 m ² . It has a pixel pitch of 50 mm.	2016	Daktronics

Source: STADIAWORLD

DIGITAL SIGNAGE: THE NEXT STAGE OF DEVELOPMENT IS IN THE STARTING BLOCKS

The use of **digital media** serves a wide range of purposes, and in the process it **supports various marketing goals**. What has already been **successfully implemented** in shopping centres, airports and railway stations is also becoming increasingly **important in stadiums and arenas**.

Advertising and information systems have also long since entered the digital era. The number of digital signage installations is doubling every year in Europe, and there is no sign of an end to the boom. Digital advertising has decisive advantages over classic forms of advertising: for example, offers and information can be placed to align specifically with target groups, and interactive elements can attract the viewer's attention.

Digital signage in general encompasses the use of digital media such as monitors, flat screens or projection systems in salesrooms and in public places, together with the content they project. In addition to freestanding or freely suspended solutions, displays can be integrated into various kinds of infrastructure. Bar and seating areas can be equipped with them in just the same way as sales areas. The options for installation are almost unlimited.

COUNTLESS OPTIONS

Digital signage is offered as a package solution with hardware and software, together with the corresponding displays. This means that the various components are perfectly matched, enabling effective use. The various components can be used to create, manage and publicise content. The displays are centrally controlled via a network server, but can be controlled independently and thus display the desired information for their respective location. This cannot be done with classic media, such as posters.

This means that the range of possible applications is huge. As well as transmitting information, digital displays can also be used as corporate TV, to show image films or to serve as a sales promotion device at the point of sale. The latter application is currently the most common one, because buying decisions are often made at the point of sale, and for this reason customers ought to be addressed precisely where the likelihood of purchasing is at its highest.

But as an advertising medium, digital signage is assuming increasing significance. Along with cinema, television, computers and mobile end devices, this is the fifth kind of screen that serves as an effective communication channel for the advertising industry.

CURRENT SURVEY

In a survey, STADIAWORLD asked experts from companies which provide digital signage about the respective future potential of the various areas of application. The individual areas were thus evaluated on a scale of 0 (no potential) to 5 (very large potential). The area of advertising/marketing was given the largest potential, with an average of 4.75. This was followed by fan TV/entertainment (4.5) and digital display of food and drink menus (4.25). Game information (3.9) and visitor information (3.7) were ascribed rather less potential – the lowest potential given by the respondents was for visitor management (3.5).



DIGITAL SIGNAGE: INSTALLATIONS IN STADIUMS/ARENAS (SELECTION)

Type	Country	City	Venue	Main tenant	Number of screens	Installation year	Producer
S	BEL	Gent	Ghelamco Arena	KAA Gent	180	2019	LG
S	BLR	Minsk	Dinamo Stadium	Dinamo Minsk	over 450	2019	Colosseo
S	ENG	London	Twickenham Stadium	England national rugby union team	700	2015	Tripleplay
S	ENG	London	Tottenham Hotspur Stadium	Tottenham Hotspur	1,800	2019	LG
S	ESP	Madrid	Wanda Metropolitano	Atletico Madrid	900	2017	LG
A	FRA	Paris	AccorHotels Arena	n. a.	417	2015	Colosseo
A	GER	Berlin	Mercedes-Benz Arena	Eisbären Berlin, Alba Berlin	200	2015	Tripleplay
S	GER	München	Allianz Arena	FC Bayern München	758	2015	Cisco
S	SVK	Bratislava	National Stadium	ŠK Slovan Bratislava	400	2019	Colosseo
BS	USA	Arlington	Global Life Field	Texas Rangers	1,400	2020	Daktronics
S	USA	Atlanta	Mercedes-Benz Stadium	Atlanta Falcons	2,500	2017	Daktronics
S	USA	Minneapolis	U.S. Bank Stadium	Minnesota Vikings	2,200	2016	Cisco
A	USA	Philadelphia	Wells Fargo Center	Philadelphia Flyers, Philadelphia 76ers	over 200	2017	ANC
A	USA	Raleigh	PNC Arena	Carolina Hurricanes	160	2019	NCR
A	USA	Washington D.C.	Capital One Arena	Washington Capitals, Washington Wizards	over 400	2018	Colosseo

Type of Sports Venue: S = stadium, SR = stadium with retractable roof, DS = baseball stadium, A = multifunctional arena

Source: STADIAWORLD

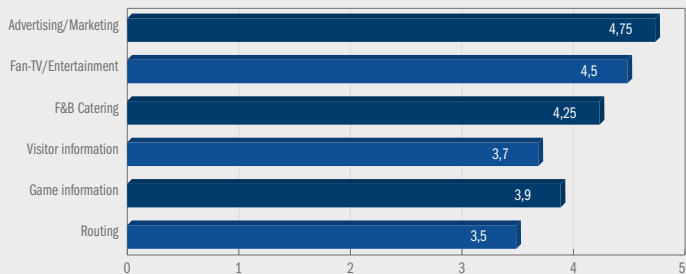
In answer to the next question, as to how far the potential of digital signage has been exhausted in the areas of application referred to, the experts from the companies think there is still room for further exploitation. On a scale of 0 (nowhere near exhausted) to 5 (completely exhausted), none of the areas of application were given a value of 4 or higher. Experts see the large as yet unexploited potential as being in way finding systems (2.3), visitor information (2.3) and digital menu boards (2.7). On the other hand, the potential of digital signage in the area of game information (3), fan TV (3.3) and advertising/marketing (3.6) is considerably nearer being exhausted.

MULTIMEDIAITY AND UP-TO-DATENESS

The advantages of digital signage in communication are obvious. For one thing, text, images, sound and graphics

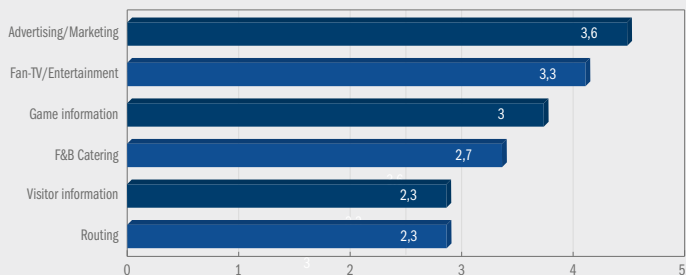
can all be displayed. No other outdoor advertising medium has this multimediality, and it makes advertising campaigns possible that have a completely different style, and which really draw the attention of the viewers. This makes it possible to address target groups that are increasingly difficult to reach via the traditional forms of advertising such as TV or printed media. Digital signage can also increase customer satisfaction, in that providing information and attractive content enhances the customer experience, and waiting in the queue can be made to be more entertaining.

Another advantage is that advertising messages can be updated quickly and easily, and with the help of real time monitoring they are always up to date. This means they can easily be adapted to time-dependent, location-specific and target group-aligned factors. For example, different age →

DIGITAL SIGNAGE IN STADIUMS AND ARENAS: WHAT IS THE POTENTIAL?¹⁾

0: no potential / 5: very large potential 1) according to suppliers

Source: STADIAWORLD survey 2019

**DIGITAL SIGNAGE IN STADIUMS AND ARENAS:
TO WHICH EXTENT IS THE POTENTIAL EXHAUSTED?¹⁾**

0: not yet exhausted/ 5: fully exhausted 1) according to suppliers

Source: STADIAWORLD survey 2019

groups are present in shopping centres at different times of the day, for whom the content on the displays can be precisely adapted – a feature that can be valuable for multi-function arenas whose clientele varies on a daily basis.

The network installations are most commonly used in department stores, shopping centres, convenience stores and supermarkets. In Western Europe this segment accounted for a third of the market in 2016. In the transport sector, or more specifically public transport, signage at airports, railway stations and bus stops comprised the second most common installations, with 26 %. One example of this is the large screens which supply the waiting passengers with information and entertainment. Event locations, which also include sports facilities, comprised just 15 % of the digital signage sector. Even though this

figure has risen over the past 1 or 2 years, we are still a long way from blanket coverage – and this is despite the huge potential. Because it is precisely here where a large number of differing groups of people come together, whose needs have to be addressed individually, in order to achieve the best advertising effect.

Bayer 04 Leverkusen were the first German Bundesliga football team to opt for the use of digital signage in their stadium. As part of the stadium's modernisation programme, 250 additional televisions and monitors were installed. The existing 100 TV devices were integrated into the system. The various multimedia content is transmitted via IP and can be controlled individually.

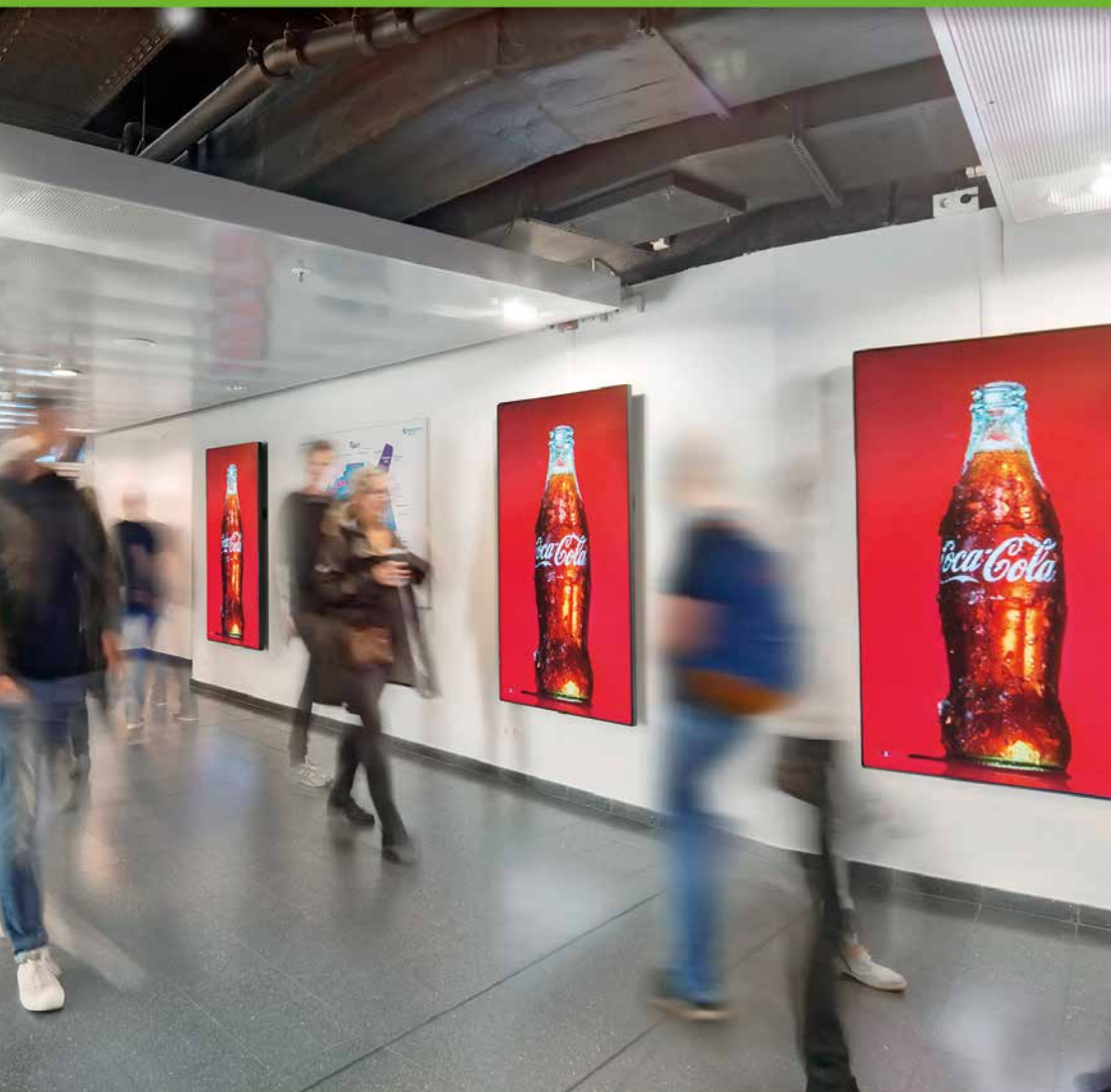
While general advertising content can be displayed around the upper rear perimeter of the stands, at the same time content that has been specially customised to suit the spectators can be shown in the VIP zone. Along with information on the game in progress, results, greeting and advertising messages from the

sponsors and from Bayer 04 stadium TV are also displayed here. On occasions other than match days, the screens can be used for greeting messages or for seminars and congresses, for example.

The advantages of digital solutions were also recognised early on at the Berlin Olympic Stadium. Using 215 plasma and TV screens, various media such as videos, graphics, scrolling text and websites are displayed. Set top boxes serve as interface between the network-based IPTV and the digital display system, and supply the screens with audio and video signals. Addressing different parts of the stadium individually is also possible here. Because the whole solution functions via IP, only a minimum of system cable routing is necessary. The server and display system can also easily be expanded using modular construction. ◆

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ADVERTISING BOARDS: NEW DIMENSIONS IN GERMAN FOOTBALL

As **sport marketing** has become professionalised, what started with wooden planks from the carpentry workshop has developed into a world of digital screens: an overview of **virtual stadium advertising in German football**.

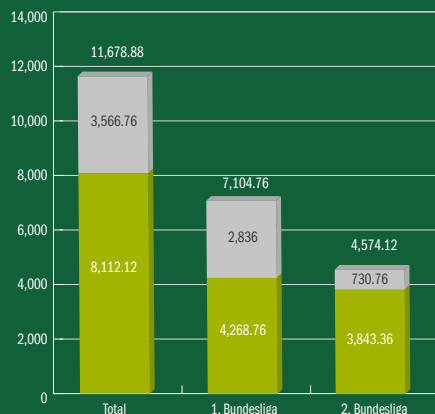
Nowadays there is hardly any area in stadiums and arenas that stage league games in professional sport which has not been marketed. In fact static and scrolling advertising boards have long since developed into digital and virtual stadium advertising.

The stadiums in the top two German football leagues are also at saturation point with regard to marketing. And in the commercial development of as yet unused areas, the approach is particularly creative. This trend has once more really picked up speed during the current decade. LED boards, which were still seen as something special at the beginning of this decade, have now become a permanent fixture, at least in the TV-relevant front row.

In the Bundesliga and 2. Bundesliga (1st and 2nd divisions), the basic configuration is practically the same in almost all stadiums: the U-shaped area defined as “back straight and behind the goal” directly adjoining the pitch in the front row differs little from stadium to stadium – also due to playing fields increasingly having to conform to standards. Around 240 linear metres per pitch can be placed directly along the sideline. The second and third rows, on the other hand, can differ more, according to local conditions. High walls next to the pitch such as those in Hamburg or Leipzig provide obvious potential.

However, this effect can also be achieved using “power packs” (like in Leverkusen and Mainz), in that the first and second rows can be staggered in such a way that they appear as one large complete display in the picture relayed by the TV cameras. The “cam carpets” laid out on the

**LED DISPLAYS:
1. AND 2. BUNDESLIGA (GERMANY)**



■ TV on 1st row ■ other

Source: STADIAWORLD

pitch surface are used to create a similar effect. Nevertheless, those observing from inside the stadium will not see this as a cohesive unbroken image, but rather as one with many different separate parts.

LED boards have become established at the 1. Liga (1st division) clubs – at least in the TV-on area, which is directed at the TV cameras. In the 18 Bundesliga stadiums there are over 4,000 linear metres. In the second row or on the back straight there are almost 3,000 metres of LED displays. In the TV-off area, the construction of the respective building and the marketing potential sometimes necessitate very individual solutions. For example, in the Allianz Arena, German champions FC Bayern München display on 249 metres of LED boards as a “U” in the front row. In addition to this there are 105 metres on the back straight in the second row. Lesser market players such as SC Freiburg (Schwarzwald-Stadion with a spectator capacity of 24,000) and SC Paderborn (Benteler-Arena with 15,000 capacity) each have 100 metres of LED boards. In the 2. Liga the “U” in the TV-on area (3,843.36 linear metres) right next to the pitch is no different from those at the 1. Liga clubs.

But LED boards not only offer advantages over static advertising for television broadcasts. The dynamic and varied content on the displays also serves to heighten the awareness of the fans in the stadium. The motion, animation and changing colours are an eye-catching spectacle for the spectators gathered there.

In the meantime, for all the clubs that have already been in the top divisions for a number of years, a level of saturation has been reached, which can hardly be bettered using conventional means. Partner advertising areas are directed at the cameras, but also at various regional target groups in the stadium. This is where virtual advertising comes into play: for example, the 250 metres of LED boards at Borussia Dortmund's SIGNAL IDUNA PARK can already also be used for virtual advertising. ◆



Picture: Imago

SIGNAL IDUNA PARK (DORTMUND, GERMANY)



Capacity: 81,365

Owner: Borussia Dortmund

250 m

TV on 1st row
(virtually usable)

44 m
TV off

120 m

TV on 2nd row
(static with LED)

REVOLUTION IN STADIUM MARKETING

Long since par for the course abroad, revolutionary in Germany. The doors to new opportunities in stadium advertising are opening, thanks to the introduction of virtual board advertising.

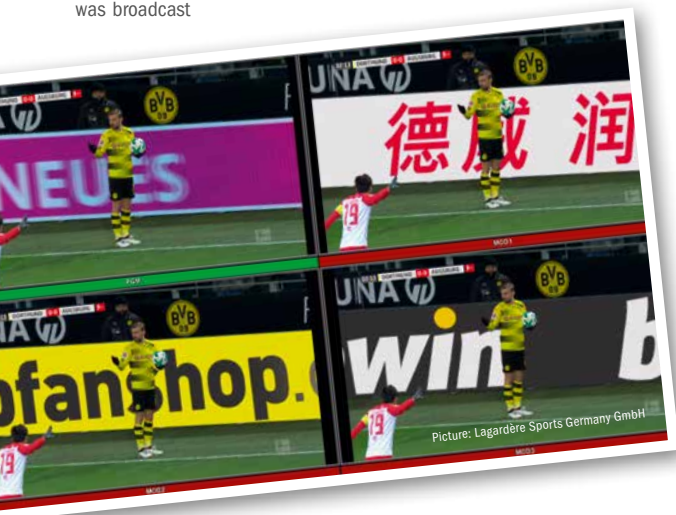
Stadiums and multi-function arenas offer a broad spectrum of marketing opportunities. Whether it's naming rights, LED advertising boards, cam carpets or fascia boards: over the years more and more innovations have been developed, which offer clubs and operators new ways to generate profit. Recently also including virtual board advertising. 15 years ago experts in Germany already began working intensively on introducing virtual board advertising into Bundesliga stadiums. Various competitors recently carried out several test runs. While virtual board advertising has already gained a firm footing abroad, it is still in its infancy here. So it took until 26 February 2018 for virtual board advertising to have its premiere in the Bundesliga, at least under live test conditions. During the game between Borussia Dortmund and FC Augsburg in SIGNAL IDUNA PARK, for the first time in Germany an additional feed was broadcast

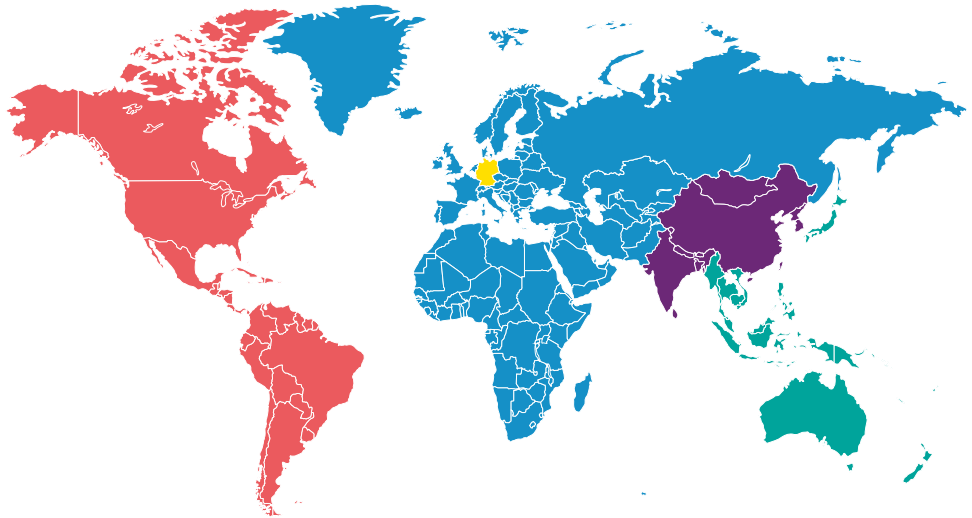
– worldwide outside the DACH region – into the international regional markets. A little while later, in March 2018, the DFL Deutsche Fußball Liga (German Football League) finally issued authorisation for the use of the technology – several years later than in the case of the Primera División (2012), the MLB or even Formula 1.

For those watching in the respective language area, the normal LED feed is still visible. Just like the fans themselves in the stadium, they don't notice any direct change. In fact the existing stadium advertising boards can be adapted individually using digital overlays in the transmission signal. In this technology the normal transmission process of a match is modified using advertising board and camera technology, achieving a virtual multiplication of the advertising space. This means individually tailored advertising content can be transmitted to different target markets. Lagardère Sports Germany, for example, market four different feeds altogether throughout the world (see diagram). Targeted campaigns can be communicated in each of these markets, and the focus on brands and sponsors can be strengthened even more.

RECORDS REVENUES IN THE LOWER SEVEN-DIGIT RANGE

In the Bundesliga, Borussia Dortmund have long-term plans for using virtual board advertising. "To the best of my knowledge, we're the only ones who have used virtual advertising on every match day at all our home games so far", declares BVB CEO Carsten Cramer. In 2018 the club signed a contract with





- 1 Americas including North, Middle, South America
- 2 Europe (● excluding the DACH region), Middle East and Africa
- 3 South Asia including e.g. India, China, Korea
- 4 Southeast Asia + Japan including e.g. Thailand, Vietnam, Malaysia

Source: Lagardère Sports Germany GmbH

their partners Lagardère and Supponor, at first for two years – “Could be we will extend this”, reveals Cramer. He says he is “very satisfied” with the system’s implementation so far and with the current situation.

In his opinion both the strict quality regulations and the patience required have also been worth it. “The DFL have done everything right, because they assigned quality the highest priority. This prevented rash decisions being taken, as was the case in a lot of stadiums abroad. The key is: the hardware must be of a quality that can withstand all weathers and be technologically stable, in order to stand up to the adversities during the match”, explains Cramer. “The standard we are working with is very high and very good. Everything I’ve heard from our service providers and partners has been extremely positive. It is important to demonstrate high standards, and to put quality first. The hardware-based version currently fulfils all the criteria. It is a stable technology. Our partners are very satisfied, the images are good. We’re very happy with how things are right now.”

Cramer is also happy with the business aspect. “The business plan exceeded our expectations of success in the first year – we recorded revenues in the lower seven-digit range”, he says,

while emphasising the positive effects of internationalisation: “But it is also significant that we have won over companies that had never placed their advertising with BVB before.”

Opinions differ among experts regarding the actual revenue potentials. The market research institute Nielsen Sports calculated an accumulated marketing potential of 60 million euros for the 18 Bundesliga clubs, which Lasse Wolter (Lagardère) sees as “somewhat unrealistic”, however. Also because of various unknowns: “Various factors come into play in marketing virtual advertising: on the one hand, decisive factors are the Bundesliga distribution channels, the number and selection of live matches in the respective target markets and the respective reach, and on the other hand, the international prestige and attractiveness of the respective club brand”, confirms Wolter.

Borussia Dortmund will definitely continue to employ this technology, at least until the end of the contract period. “We want to develop this further – we’re really having fun with it”, says Cramer. “Virtual advertising is going down very well with our partners, but also with our fans abroad. As far as revenue potentials are concerned, virtual board advertising is an absolute growth area.” ◆



FASCIA BOARDS: COMMUNICATION AND INTERACTION

What has long since been a familiar feature in multi-function arenas and stadiums in the USA was still a novelty for Germany and the rest of Europe when the Mannheim SAP Arena opened in 2005: the all-round rotating LED display, the fascia board (also called a ribbon display) on the edge of the upper tier, was constantly cited as one of the technical highlights of the new construction project. The Anschutz Entertainment Group (AEG) arenas in Berlin and Hamburg opened in September 2008 and 2010 respectively with just such an LED installation from the very start, thereby practically importing a US standard into Europe. In parallel with the stadium boom in Germany, a large number of top-level arenas were built; however, not all of them invested right away in digital upper tier ribbon displays. But the LANXESS arena in Cologne, one of the world's leading arenas, has now launched a project in which the rotating displays on the upper tier are to be upgraded to LED modules. In this, Germany's largest arena, the display will be

315 metres long. The centrepiece of this ambitious update project is a new video cube, which is to replace the existing 4-sided model installed in 2007, which weighs 20 tons, its sides measuring 27 m². As another example of a world class stadium in Germany, Borussia Dortmund is equipping its SIGNAL IDUNA PARK from the summer break 2019 onwards with a 400 metre-long fascia board, which will stretch almost all the way around the upper tier of the giant building.

Looking at Europe during the peak of the construction projects, similar trends towards installing permanent digital ribbon displays developed in parallel, especially in England. At the new stadiums in Wembley and Twickenham, two top class venues treated themselves to these digital ribbon displays. In the meantime, as another market leader, Tottenham Hotspur has followed suit and equipped its new premises with ribbon screens: the ribbon displays on the middle and upper tiers run →

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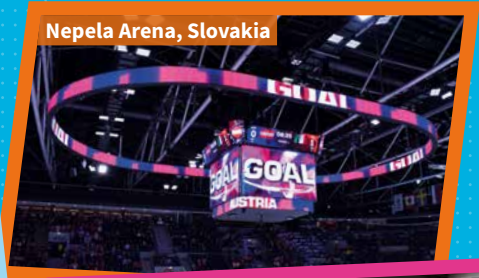
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from the eastern to the western stand. The LED ribbon display on the upper tier is 387 metres long, while the middle tier display measures 348 metres. On the lower tier, the ribbon display runs in two separate sections. A 122-metre ribbon display is installed along the eastern stand, and a 105-metre display along the western stand.

Yet the most recent highlight has been installed in 2019 in the Gazprom Arena, St. Petersburg, by Colosseo. It is what the company calls „the world’s largest LED ribbon board“ and measures 2.2 metres by 590 metres (total: 1,300 m²).

An investment of this kind is sizeable, and only brings measurable benefits at locations with high marketing potential. It enhances the fan experience considerably, for example when goal scorers are celebrated via overlay on the rotating display. Keywords such as “emotion”, “communication” and “interaction” are frequently used to illustrate the positive effect of LED solutions. The content displayed comprises a mix of programme information about coming events and set advertising segments with content from partners. As well as this, operators strive to make use of the whole of this instrument’s potential to address the target group in the venue directly, by way of live infotainment.

An investment of around 2,500 euros per linear metre can be expected. Assuming a mean value of 250 linear metres per arena, on average a fascia board will cost 750,000 euros. As previously mentioned, shorter displays can be installed where budget is limited. Whether a conclusive economically feasible concept can be derived from basic data of this nature is at the discretion of the respective operator or club, and depends on their realistic assessment of the marketing potential.

With their colourful mix of events, multi-function-arenas are known for being used closer to their full capacity than stadiums. The situation might be different in the USA – but in any case in Germany and in Europe as a whole, there is still a general atmosphere of reticence when it comes to deciding in favour of fascia boards. Although most stadium operators, at least those operating multi-functional stadiums, are certainly interested in the technology. But in view of the comparatively low number of event days, and the much bigger areas

which have to be equipped, the initial investment seems to be too high. But the more multifunctional an arena is, the more relevant fascia boards become. Nevertheless, the Frankfurt Commerzbank-Arena indulged in an LED ribbon display on the upper tier of the back straight.

INDIVIDUAL ARCHITECTURE

Because every arena has its own architecture, there are no uniform standards regarding the installation of the module, so in this respect every project concerns an individual solution. For example, the conditions and the lines of sight can mean the ribbon display has to be of shallow construction on the upper tier. In some arena, the modules are removed for maintenance, while in others they can be flipped open. In the Hallenstadion Zürich the 2 metre-high fascia board was suspended from the ceiling – this required a particularly lightweight construction. There can also be differences in how the fan is installed. They are temperature-controlled, and must be switchable, should events be particularly vulnerable to background noise. But when they are run without a fan, the modules have to lose 10 – 15 % of their brightness. And where it is advisable to fit a vandalism guard, due to the proximity to the spectators, in some cases a protective device will be needed to prevent the intrusion of spilt drinks. When a building contractor and the subsequent operating company consider installing a fascia board, it makes sense to integrate this into the planning from the start. ♦





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LED-TECHNOLOGY: KEY FACTS AT A GLANCE

- LEDs are diodes, in which electrons emit radiation energy in the form of light.
- For multicolour image reproduction, units comprising three diodes (red, green, blue) are required to reproduce the whole colour spectrum in the RGB colour model.
- Three of these diodes together constitute one pixel.
- Pixel pitch defines the physical resolution of a system – the smaller the distance of the diodes from each other, the higher the resolution.
- Virtual pixels are created when software simulates a fourth diode.
- SMD technology groups three diodes on each printed circuit board, thus achieving higher resolution.
- Resolution is related to viewing distance: the smaller the pixel pitch, the nearer the viewer can be to the LED module, and still see a good quality image.
(With a pixel pitch of 20 millimetres, the minimum viewing distance is 20 metres.)
- The colour depth (bits) denotes the number of possible brightness gradations per pixel. For example, 8 bits = 256 gradations per diode = 16.8 million gradations per pixel.
- The processor power of an LED system influences the frequency at which it can generate the countless individual images, which the human brain interprets as moving images. The rendering frame rate is measured in hertz and megahertz (Hz/MHz).
- The luminance of LED displays is generally given in the unit “nit”. For example, outdoor video walls typically measure 5,500 to 8,000 nits.



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