WE ARE IMAGING

Photo and Imaging Market

TREND REPORT 2016

FOREWORD

RAINER FÜHRES
Chairman of the board

A FUTURE WITH GOOD PROSPECTS – OPPORTUNITY BY MEANS OF CHANGE

The imaging world – indeed, the entire imaging industry – is undergoing a transformation of utmost importance in its 175-year history. Fifteen years ago, some people may have still thought that the shift from the analogue imaging world to the digital one would be the most challenging development in our industry; now we realize that the shift from the digital imaging world to the smart one is far more challenging, placing great demands on our technologies, on communication within the industry, and on our current as well as future business model. This means that fundamental changes are shaping the picture. The imaging industry is transforming into a provider of integrated solutions involving hardware, software, and services. Innovations are arising, and, as an industry in the classical market, but also in the market for future-orientated, industry-wide imaging applications, we have to use them to expand our market position.

The face of our industry that emerges from this is the symbol of the extended sphere of activity involving photos, videos, imaging, and visual communication: a new imaging ecosystem. Yet this is not a fixed construct; it must be understood as a dynamic process. New players, technologies, and market segments are continually added; products and services that exist today may wind up being replaced.

Imaging, as a key technology, can be found today in almost all spheres of daily life – in science, medicine, and technology and in industrial manufacturing processes. The imaging world is smart, guaranteeing intelligent aspects of life that influence every single individual in both the private and professional realms with its applications.

With all of these changes, the image is and, in future, will remain the driving force of our action. It will grow even more significant as our tasks expand, allowing the industry to tap into new market potential.

As representatives of our members' interests, we aim to stimulate new ideas in the industry, as well as to provide active support in further developing and gaining access to new markets. We look into the future with great confidence. The industry's transformation, despite all the uncertainties, presents a tremendous opportunity for the shaping and restructuring of our imaging world.

The following report gives you an overview of the photo and imaging market and comprehensively explains current market trends.

We wish you many new insights in reading our brochure.

RAINER FÜHRES
Chairman of the board of the
Photoindustrie-Verband (PIV)

Embedded in the Global Economy

The Future Photo and Imaging Market

CHANGED USE OF IMAGES AND IMAGE TECHNOLOGY

The shutter never stops clicking. Nearly every moment, somewhere in the world, someone is saving a photo on a memory card. For 2016, Infotrend expects consumers to permanently store 1.138 trillion more photos. Reporting on photo sharing around the globe, Brandwatch calculates that 350 million photos are shared on Facebook, 95 million on Instagram, 400 million on Snapchat, and 1.6 billion via WhatsApp every single day. More than ever, pictures are a natural and expected means of communication, enriching all aspects of daily life.

This change in the use of images would not be possible without the technological infrastructure of the modern imaging industry. The array of products and services for taking, processing, saving, transferring, presenting and archiving images is more varied than ever and is continuously expanding. As this unfolds, the imaging industry is integrating know-how from imaging processes, as well as from mechatronics, IT, consumer electronics, robotics and other related fields. Not least because of this, the imaging industry is intertwined with economic development around the world, and above all with the overarching trend of digital transformation.

DIGITAL TRANSFORMATION: DRIVING GROWTH

Various media outlets and analysts like to report on the declining sales figures for cameras and accessories

like camera bags, flash devices and interchangeable lenses. But this presents an incomplete picture of the future prospects of the imaging industry.

Statistics gathered according to conventional criteria misjudge the evolving market situation, which involves an expanding imaging ecosystem that is generating new segments with enormous added value, such as virtual reality, augmented reality, cloud computing or multicopter cameras. Imaging technology is indispensable in many intelligent solutions related to mobility, automotive products, security, smart home, and medical technology, as well as robotics, paving the way for growth and sales opportunities in the imaging industry to reach new and heretofore unimagined dimensions.

"Smart" without imaging technology is now hardly conceivable. One example is the much-hyped augmented reality game Pokémon Go, in which one aims to hunt small creatures put into play in one's actual surroundings and shown on the display; the smart phone's GPS system communicates what those surroundings are. These could not be represented without imaging technology.

MODERATE ECONOMIC CLIMATE ENCOURAGES CONSUMPTION

The general economic situation varies across the regions of the world but, all in all, it encourages the consumption of imaging products and services.

Germany: Unemployment in Germany, at 5.9 %, had dropped to its lowest level in 25 years in June 2016. According to the Bundesagentur für Arbeit (BA, Federal Employment Agency), there were 2.614 million people registered as unemployed – 97,000 fewer than one year before. The BA does not expect "any dramatic effects" in the German labour market from the greatest current event with European economic implications – the British Brexit vote.

Nonetheless, the economic situation and consumer confidence in Germany were not entirely unaffected by the Brexit decision: it has generated insecurity. As the market research firm GfK established, consumer confidence in July dropped slightly. The predicted global consumer-climate indicator for August stands at 10.0 points, a tenth of a point down from July (10.1).

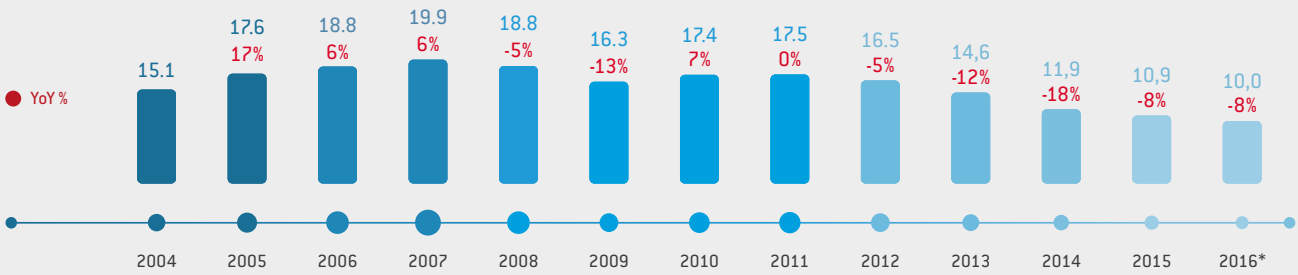
Whereas the overall economic and income expectations suffered some losses, however, consumers' propensity to buy increased slightly once again. From this, it can be assumed that private consumption will remain an important pillar of Germany's economy in 2016, with the photo and imaging industry also positively influencing this.

According to the GfK, the real expenses for private consumption will rise this year by about two per cent. This may have to do with the fact that Germans are quite optimistic about the development of their incomes. Contributing significantly to this are the very stable employment figures, almost nonexistent inflation, growth in buying power from the recent collective bargaining agreements, and the noticeably higher state pensions.

Only the current rise in the risk of terrorism in Germany could increase citizens' insecurity and

IMAGING MARKET - CAMERA MARKET TRENDS IN EUROPE

Value in million €



 - Source: GfK 2015, Executive Imaging Report, 11 August 2016

*Estimate as of 04.2016

thus negatively impact their propensity to buy. If this happens, however, one can assume that imaging technology in the security sector can compensate to some extent for the drop in private consumption. The diversified positioning of the photo and imaging industry allows for this sort of equalisation.

Europe: In the European Union (EU-28) with its total of around 510 million consumers, the economic situation does not look quite so good as in Germany, particularly since media discussions in the second quarter were dominated, in part, by topics that were not beneficial to the economy. In Austria and Spain, elections took place during this period, whereas the sanctions against Russia or the negotiations about new EU payments to Greece took center stage in other countries. In Italy, the media landscape was dominated by the refugee dramas taking place there.

In addition, the unemployment rates in the individual EU countries are very different. In Greece, it is 23.4 per cent, and in Spain it is 19.9 per cent, whereas in Italy it is 11.6 per cent and in Great Britain 4.9 per cent. The statistics service provider Statista puts the EU average unemployment rate at 8.6 per cent. Accordingly, consumer climate indicators have not developed uniformly in the various European countries.

Nonetheless, the seasonally adjusted gross domestic product (GDP) of the EU-28 rose by 0.4 per cent in the second quarter of 2016, as Eurostat published. According to the GfK, the consumer climate for the EU-28 from March to June 2016 rose significantly, by 4.1 points, to 13.1, which is the highest value since March 2008 (16.8 points).

The robustness of consumption in Europe may seem surprising in light of the fear of terrorist attacks, increasing scepticism about the European project, and apprehension that the refugee agreement between the EU and Turkey could collapse. Yet apparently, consumers are not relating current news to their personal lives and are not letting their desire to buy be spoiled – except, perhaps, for trips abroad.

Japan: Japan is the home of several big-name manufacturers of the photo and imaging industry all at once. According to the Japanese camera association CIPA, around one-third of Japanese exports of digital cameras (34 per cent) goes to Europe. The currency

EXPECTED ECONOMIC ACTIVITY IN EUROPE

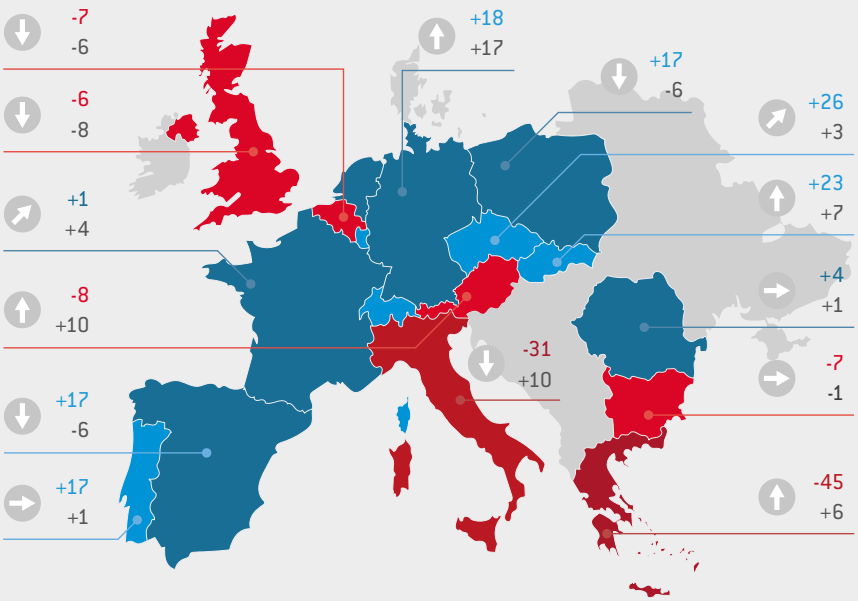
JUNE 2016

- Indicator > +20
- Indicator 0 to +20
- Indicator 0 to -20
- Indicator < -20

EU total +1

Change of indicator: March to June

- > +5
- 1 to 5
- -1 to +1
- -5 to -1
- < -5



Source: GfK, EU Commission

situation is causing trouble for Japanese exporters. Whereas the euro was worth 149 yen in 2014, it is now worth only 113 yen. The Japanese currency has also risen against the US dollar, which is poison for Japan's export companies. Japan's prime rate has hovered around the zero mark for several years already. Stimulus packages have been passed to boost growth. Exports are correspondingly important to Japan's photo and imaging industry.

In addition, the market development for compact, single-lens-reflex and compact system cameras of Japanese manufacture will continue to feel the impact of the Kumamoto earthquake of 14 April 2016 for some time yet. Products remain scarce, as before. Even though the situation is gradually beginning to normalise and production has begun again on many products, the demand can still not be completely met. The introduction of previously announced innovations for the spring season has been delayed by the earthquake, which is exerting additional influence on the market development in 2016.

Moreover, given the supply shortages, the market is essentially not being promoted so that demand that cannot be satisfied is not generated. At the present time, it is difficult to predict the extent to which the decreases precipitated by the earthquake can be compensated for by the end of the year.

Global economy: Globally, the economy grew by 3.1 per cent in the year 2015, according to Deutsche Bank Research, and the growth estimates for 2016 amount to 3 per cent. Drivers of growth, as before, are India, China and other Asian countries (except for Japan), even though the growth rates in these countries, at 6 and 7 per cent, are no longer as high as in previous years.

Worldwide, the photo and imaging industry has profited from new segments, its innovations with what already exists, and its adaptability. Whereas the sale of cameras, for example, has decreased worldwide, the industry is enjoying growing sales figures for action cams and smartphones. Moreover, 360-degree cameras are currently generating headlines with the VR trend. In addition, it is clear that the variety of image-recording devices is continuing to increase.

The sale of tablets declined earlier than predicted on the world market, whereas, as before, more smartphones are being sold, especially in China and other Asian countries. This may possibly correlate to a shift toward more people watching films on their smartphones, which are becoming larger, so that they no longer need tablets. This assumption is supported by significant worldwide increases in the sale of high-resolution flatscreens. When 4K and UHD TVs were introduced in the year 2013, at first, they were still very expensive. As the price dropped when production increased, in this case, too, the number of devices sold increased several fold.

POSITIVE FUTURE TREND: INTERTWINING OF TECHNOLOGIES

All in all, it can be concluded that the photo and imaging industry is undergoing a transformation and is highly connected to technological development in other areas. If cameras and accessories were the key segments in analogue times, the portfolio of the imaging industry has become much broader as a result of the digital transformations. This makes it necessary for the industry to be able to innovate and adapt in order to establish and go along with new trends. The industry's development is moving away from merely supplying hardware to offering software and service-oriented products and to entirely new fields of application and business models.

It supports the photo and imaging market that photos and videos currently present unprecedented potential in entirely new areas. Imaging technologies are part of a rising tide, having made their way into ever more fields, such as the security, medical, automotive and gaming industries. Although the photo and imaging industry was always a component of the technology sector, more and more it is developing toward high-tech. The photo and imaging industry is currently demonstrating that it is in a position to actively shape this transformation by cooperating with other technology providers from entirely new sectors. Accordingly, the future prospects for the industry are interesting and multifaceted.

Imaging Ecosystem

The Digital Transformation Is Redefining the Photo and Imaging Industry

In the analogue age, media coverage of the photo and imaging market was primarily concerned with the sale of cameras, lenses, tripods, and camera bags. As usual in business, there were cycles of upswings and downturns – currently, a downward trend can be discerned in some segments.

In the world of today, with its digital transformation, the ecosystem of the photo and imaging market has expanded tremendously. Many companies have shifted from being hardware specialists to providing additional software and services and have expanded their portfolios to include further segments – including business-to-business (B2B) operations. Consequently, the imaging market and its interpretation are becoming ever more complex. As the imaging ecosystem continues to expand, the photo and imaging industry, as the definitive innovator of the new digital world, is gaining new strength in all the fields that are revolutionising private, professional, and social activities.

B2C: SMART TECHNOLOGIES ARE EXPANDING POSSIBILITIES

Digitalisation revolutionised photography with its players and brought it into new, more complex areas. In the early days of the innovations, the sales arguments were simple, essentially focussing on mantras like "more pixels = higher picture quality". With the technological progress of current innovations, a great deal more communication is needed, and thus generating sales arguments is correspondingly more challenging.

Digitalisation has made the entire imaging workflow, from taking pictures to distributing pictures and rolls of film, more multifaceted. The product array is growing larger by the second in light of the range of cameras and possibilities. Demands for imaging equipment and a smart workflow are increasing. In all fields, the shift from the digital to the smart imaging world that has begun is much more challenging than the shift from the analogue to the digital imaging world that took place more than fifteen years ago.

Products from the analogue era, such as instant pictures, should not, however, be written off when one looks at the present market. It is precisely such products that are experiencing an unprecedented boom among the generation that is accustomed to rapidly browsing through pictures by swiping across the display.

New "distribution media" today include services like Facebook, Instagram, Youtube and Pinterest – this, too, is a billion-dollar industry, which lives on input in the form of pictures and videos, as well as business models. They expand the imaging ecosystem, with the imaging industry also increasingly growing together with the new service providers.

The smartphone continues to be regarded as competing with cameras – mistakenly – because industry outsiders principally associate the decline in sales of small, compact cameras – which was predicted anyway – with the boom in smartphones.

However, this view overlooks the fact that camera manufacturers also have smartphones in their portfolio, and that pure camera manufacturers have been entering into cooperative agreements with smartphone manufacturers so that they can mutually strengthen one another. Smartphones – this point is beyond question – have raised the omnipresence of pictures and videos and have played a vital role in making pictures an integral and indispensable part of any sort of communication. Moreover, smartphones have contributed to opening up entirely new sales markets that add great value and scope to the imaging industry – consider, for example, apps.

B2B: IMAGING SOLUTIONS MAKE TECHNOLOGIES MARKETABLE

Technological development and the Internet of Things are giving the photo and imaging industry an entirely new boost – especially those technologies that are first utilised in the B2B field and then later influence B2C segments. It has become impossible today to imagine the networking of various application and technology fields without imaging technologies. Here is a small selection of examples:

Smart Home: In this application, cameras are placed on or inside the refrigerator. Consumers can check the contents when they are out and about via the Web. Various security technologies for the household also utilise imaging technologies – from door openers operated remotely by a smartphone to burglary prevention.

Robotics: The increasing use of robots in private life, the business world and science is an important topic in the imaging industry that continues to grow more relevant. Without high-quality 3D cameras, image algorithms and displays, the robots used in industry, service, research and household applications cannot do anything.

Automobile: New high-end cars nowadays no longer leave the factory without a camera system that enables the driver to see all around the car on a dashboard monitor. Parking help with reverse cameras, distance sensors and other driver assistance systems require wide-ranging uses of imaging technology. Even traffic wardens who monitor parking do this today by using digital cameras for proof. Traffic guidance systems and automatic distance and speed measurements on the highways would not be possible without imaging technologies.

Security and Military: In the security field, imaging technologies are indispensable and are utilised almost everywhere, such as in border monitoring systems with cameras, similar drones, as well as infrared cameras, also used for reconnaissance, for example. In order to manage the flood of information, imaging processes for the recognition of vehicles, movement and faces are also needed. These, in turn, function best when the images are of good quality, and intelligent analysis software can be used to interpret them.

Medicine: The photo and imaging industry is increasingly being used in the field of medicine. Where people had to be cut open and surgical procedures were previously required, minimally invasive operations by means of a probe mounted with a camera are now the norm. Robot operations in areas that are difficult to reach – be they crisis areas or developing countries – can now be carried out with the help of camera technologies. In the same way, rare operations can be performed by teams of experts who do not have to leave their usual place of work to do them. To the extent that imaging companies have not yet established themselves in the medical field, they are now increasingly expanding their portfolio by means of acquisitions or cooperative agreements.

Manufacturing, Testing, Logistics: In manufacturing and testing, photo and imaging providers also have a role to play. Bottling and filling equipment, as well as quality control, can no longer be imagined without optical systems. But in the modern field of material testing, too, high-quality camera technology is being utilised for recognition of porosity and hairline cracks.

The possibilities for innovations in the imaging industry are by no means exhausted by this list. Almost daily, new information comes in about milestones in basic research in optics and image sensors, about new, fascinating applications in virtual and augmented reality, about inspiring imaging apps and practical connectivity functions, and about much more. The imaging ecosystem is very lively and is constantly presenting us with new opportunities to see the world through new eyes.

Digital Transformation in the Commercial Landscape

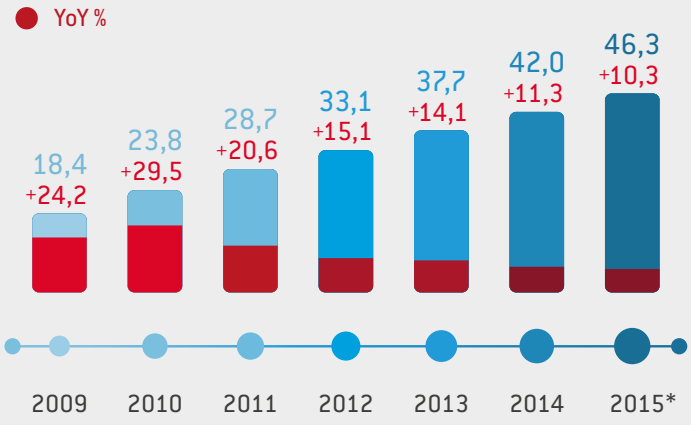
The digitalisation of the commercial landscape presents a tremendous opportunity that brick-and-mortar retailers have profited from when they have intelligently combined various sales methods. Along with the expanding Imaging Ecosystem (hardware, software, services), the distribution channels (B2C/B2B) are quite varied and are characterised by specialisation in a core area.

47 million people, according to the German Federal Statistical Office, made purchases via the Internet in Germany in the year 2015. In the estimation of the Institut für Handelsforschung (IFH, Institute for Retail Research), they accounted for a sales volume of 46.3 billion euros in online sales – about 10 per cent more than the previous year. Despite these growth rates, the impressive number only comprises about 10 per cent of the total German retail sales volume. To put it simply: Even in the digital age, 90 per cent of retail sales take place in brick-and-mortar buildings. Even when daily consumer goods, called “fast-moving consumer goods” in the jargon of the trade, are subtracted from the calculation, the portion of classical retail sales still remains well above 80 per cent.

Technological consumer goods tend to be purchased through online channels especially often. Surveys conducted by the GfK (Gesellschaft für Konsumforschung, or the Association for Consumer Research) show that in the year 2015 in Germany, almost every third euro used for camera purchases was spent in an online shop. It was not only the Internet specialists like Amazon and Co. who profited from this, but also specialty shops and photo retailers with their far-reaching online strategies, ranging from Internet shops to marketing and advertising strategies to retain customers and generate new target groups.

MARKET VOLUME ONLINE RETAIL

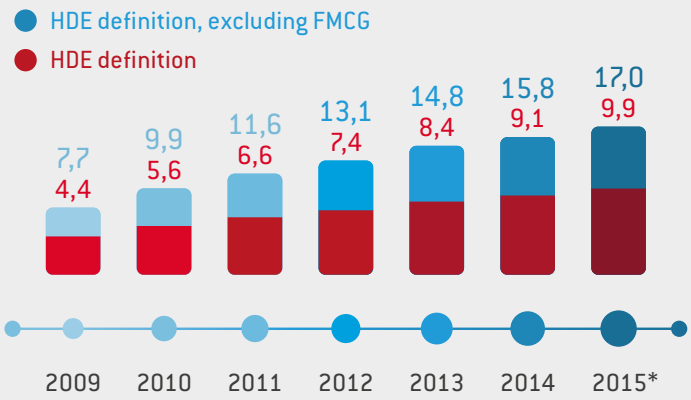
Sales in billion €



© 2016 Photoindustrie-Verband (PIV) *Estimate
Source: IFH Köln, Branchenreport Online-Handel, 2015 edition

ONLINE SHARE OF RETAIL SALES

Value in %



© 2016 Photoindustrie-Verband (PIV) *Estimate
Source: IFH Köln, Branchenreport Online-Handel, 2015 edition

NOTHING WORKS WITHOUT THE INTERNET

An inviting, professionally designed Internet presence, along with e-mail marketing and search engine optimisation, are the most important requirement for a retailer to manage to survive into the future. The best way for retailers to reach their customers locally is via smartphones, which about 45 million people in Germany use. For example, the information service “Think with Google” reports that in the USA 50 per cent of consumers who search for a local dealer on their smartphones will also seek out a shop within a day. Conversely, every fourth person will dispense with going into a retail shop if he does not know whether the desired product is available.

A RECIPE FOR SUCCESS: OMNI-CHANNEL MARKETING

Experts agree that the future of retailing lies neither in the online shop alone nor exclusively in the brick-and-mortar store. Consumers themselves confirm this, as well. An IFH poll indicated that even young consumers, the “smart natives” born after 1990, do not expect online shops to be able to replace classical stores. In a survey, almost three quarters of respondents in this age group replied to this sort of question with “No”. Apparently, consumers follow two different paths depending on what it is they wish to acquire: At classical retailers, they expect individualised advice, personal contacts and the opportunity to touch and see or maybe try out the products. Online dealers, by contrast, seem attractive for their large selection, delivery directly to consumers’ homes, and, of course, their unlimited hours of operation. Thus, young consumers, especially, choose where to make a purchase according to the desired product; and they do not always use online shops to make purchases but also as a digital shop window where they can gather information at any time.

The recipe for success for retailers lies in Omni-Channel Marketing, the intelligent interlinking of

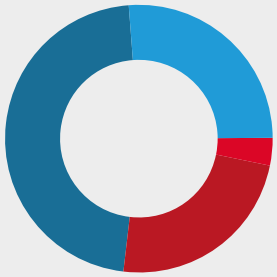
digital offers and the classical expertise of a brick-and-mortar business. Online specialists know this by now, too. The Internet giant Amazon opened its first brick-and-mortar shop in Seattle in the fall of 2015, and has added two more in other American cities since then. In Germany, too, successful Internet retailers, such as Cyberport, Long Tall Sally and Fashion-for-home, have opened retail shops in order to reach customers through them as well.

The interlinking of digital offers with brick-and-mortar shops is not a vision for the future. The Munich communications agency Serviceplan, together with partners like Cisco (network technology) and Vitrashop (shop fitting/design), has developed a modular concept called We-Shop that retailers can use to respond with competence to the changed shopping behaviour of digitally connected customers. This not only makes use of a professional online presence and modern shop design but also digital instruments

> "Omni-channel marketing is the future: combining digital channels with in-store guidance"

DO YOU THINK THAT ONLINE STORES CAN REPLACE BRICK AND MORTAR SHOPS?

Value in %



- 46,8 % less likely
- 26,3% no
- 23,7% more likely
- 3,2% yes

n=528 (Smart Natives)

 - Source: ECC Köln, Cross Channel2020 - Smart Natives im Fokus, Cologne, 2014

that enable retailers to reach, accompany and, ideally, lead customers into their shops during every phase of their buying decision. This is made possible, for example, by beacon technology, which allows customers to be identified by means of an app on their smartphones. In this way, dealers can also reach consumers outside of the shop, for example, by means of an intelligent display in public space, with personalised advertising, or even send them push messages with specific offers on their mobile devices. “Walk-in customers” without an app can be made aware of the dealer‘s offer by means of a QR code or a short URL on the display. At home, too, customers can be reached via their smartphone, tablet, PC or even smart TV. With a chat function, they can take up contact with the dealer directly, for example, in order to ask a question about a product.

THE DIGITAL STORE

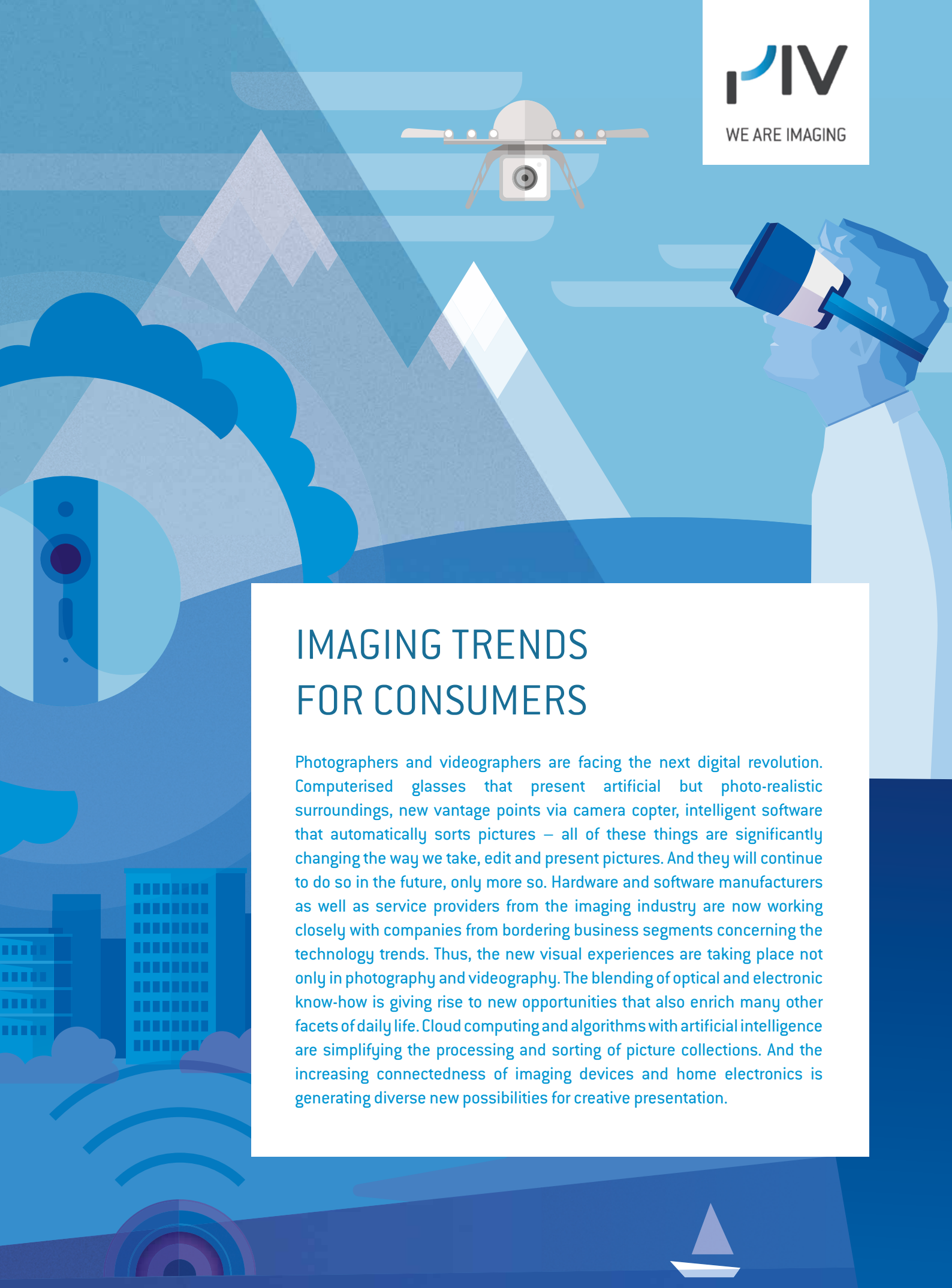
Once the customers have arrived in the store, the digital communication is still far from over. More and more often, tablets and displays can be seen on the sales floor or in the display windows. They can recognise regular customers by their smartphones and show them personalised offers. Displays can even target unknown customers nowadays after their age and gender, for example, have been ascertained with the help of cameras and special software.

Meanwhile, for the classical strength of specialty stores, too -- personal advice -- digital communication is increasingly in use. For example, there are intelligent sales tables that present important information on a built-in display. An RFID Reader automatically recognises products set on the table so that the correct information or suitable accessories can be shown. Such scenarios are not just visions from science fiction: The necessary technologies have been market-ready for some time, and lots of information about products that one needs for digital communication with customers is already available in the store databases that are used for Internet offers and online shops.

SELLING INNOVATIONS AND GAINING NEW PRODUCT SEGMENTS

High-quality single-lens reflex cameras and system cameras, but also premium compact camera models, according to the GfK, are purchased at qualified photo retailers especially often. Specialty shops have not only been able to maintain their market share in these segments but even expand it in some areas. And, of course, the photo trade has come to encompass new product segments, as well, over the course of the digital transformation. The futuristic technology of virtual reality is already standing on the doorstep of photo retailing: However, 360-degree cameras, new imaging processes and the services that go along with them need to be integrated beyond merely incorporating them into the product array. It is just as important to have competent sales personnel to market them.

The transformation has not only generated new products for photo retailing but has also given rise to completely new business models that go beyond simply the sale of goods. For example, the sharing economy is taking up residence in photo retailing because those who produce imaging have realised that many consumers no longer necessarily need to possess the products in order to use them. This trend presents new opportunities for specialty shops to act as intermediaries who manage and maintain the rental equipment. In addition, the sharing economy can help generate new buying incentives.



WE ARE IMAGING

IMAGING TRENDS FOR CONSUMERS

Photographers and videographers are facing the next digital revolution. Computerised glasses that present artificial but photo-realistic surroundings, new vantage points via camera copter, intelligent software that automatically sorts pictures – all of these things are significantly changing the way we take, edit and present pictures. And they will continue to do so in the future, only more so. Hardware and software manufacturers as well as service providers from the imaging industry are now working closely with companies from bordering business segments concerning the technology trends. Thus, the new visual experiences are taking place not only in photography and videography. The blending of optical and electronic know-how is giving rise to new opportunities that also enrich many other facets of daily life. Cloud computing and algorithms with artificial intelligence are simplifying the processing and sorting of picture collections. And the increasing connectedness of imaging devices and home electronics is generating diverse new possibilities for creative presentation.

Image-recording Devices

It's a Lot about the Eyes

Never has there been more variety in the camera market; never have photographers and videographers had as much scope as today. Cameras can fly; they can simultaneously film and take pictures; they take pictures rich in detail with two lenses, keep everything in a 360-degree view at once, and in the process are getting even smaller. And that isn't even close to everything that the research departments have in mind for the coming years. Although the market for established categories of cameras is challenged, the future has already arrived: Digital photography and videography as well as smart solutions are continuing to grow together. The imaging industry is conquering new business segments. The prospects are so promising that numbers can hardly illustrate them.

THE MARKET

The market for capturing devices has been undergoing a transformation from the digital to the smart imaging world for several years now. At the same time, the variety of capturing devices in the imaging ecosystem is growing. Along with the sale of cameras for amateurs and professionals in the B2C market, new business segments are emerging for visualising technologies in the B2B area: in automotive engineering and security, in industrial production, as well as in science and medicine. These are the increasingly relevant market segments that will compensate for declines in some established categories of cameras for end users.

PIV and GfK calculate that, worldwide, there will be overall declines in the sale of compact, single-lens reflex, and compact system cameras in 2016, too. The negative consequences of the Kumamoto earthquake in Japan in April of this year will continue to be felt. Because production was disrupted for some time, the full demand cannot be met. In addition, many anticipated innovations were postponed.

However, the negative development does not affect all single markets and segments. The sale of compact system cameras in Germany, for example, according to PIV and GfK, will remain at the level of 2015, with 275,000 units sold this year compared to 276,000 the year before. The sales volume, however, will rise from 190 million euros (2015) to 205 million euros (2016). This suggests that consumers continue to be willing to spend money on higher-priced purchases. Consequently, the imaging companies' bet of focussing on premium products with greater added value is paying off. This may increase the current interval of about five years between camera purchases.

The nosedive in the compact and single-lens reflex camera segments that began some years ago may be over by 2017. But it will also be necessary to make consumers aware of the new features, which require much more intensive communication, so that they see the benefits for themselves.

The action cam segment continues to enjoy unbridled momentum. This camera category is experiencing a record year both in terms of the value and quantity of sales. The "shooting stars" of the camera market may be playing a role in this: 360-degree cameras that take spherical panorama shots with several lenses – a virtual reality headset can also be added for experiencing them. At the same time, the niche for camcorders is getting smaller, which can be attributed to the video function in cameras.

The smartphone segment can be expected to have slight increases at the high end in both the quantity

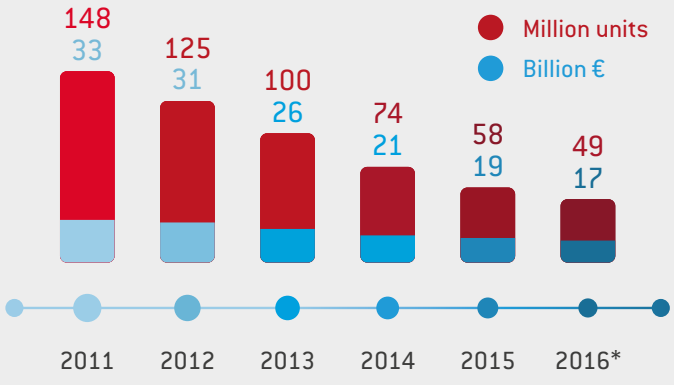
With more than **10.5 million** units sold globally in 2016, action cams are having a record year yet again.

and value of sales in 2016. Photo functionality was a particularly strong focus of innovations this year, animating the demand for premium devices, in particular. Asia and Africa as countries with growth markets, likewise, continue to spur growth in the smartphone segment.

Bodycams present a rather new camera category, with police and security personnel increasingly being equipped with them. The market will continue to pick up speed in the coming years. IHS estimates worldwide sales for 2015 at 135,000 units. Dashcams, cameras very similar to bodycams and mounted behind the windshield, constitute a market with further growth potential. The GfK forecasts that 2 million dashcams will be sold in Europe for 150 million euros in the current year.

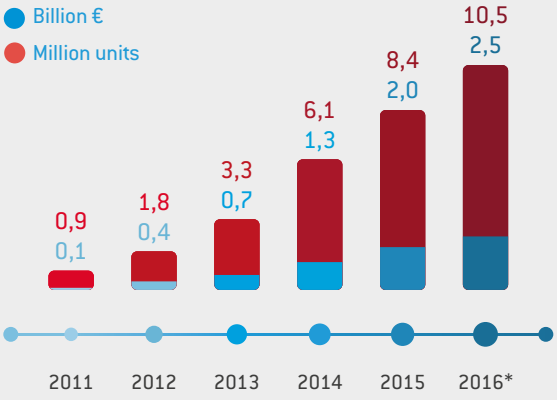
TOTAL GLOBAL DIGITAL CAMERA MARKET (INCL. NORTH AMERICA)

PIV WE ARE IMAGING



Source: GfK
*Estimate as of 08.2016
GfK

ACTION CAMS, GLOBAL (INCL. NORTH AMERICA)

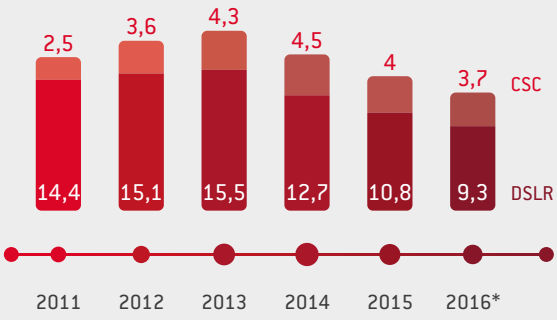


Source: GfK, August 2016
*Estimate as of 08.2016

GLOBAL MARKET TRENDS IMAGE-RECORDING DEVICES

COMPACT SYSTEM CAMERAS (CSC) & DIGITAL SINGLE REFLEX CAMERAS (DSLR), GLOBAL (INCL. NORTH AMERICA)

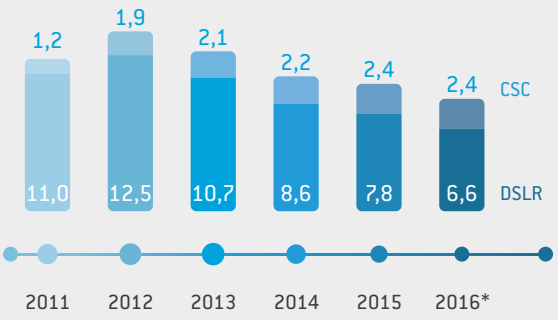
Million units



Source: GfK, August 2016
*Estimate as of 08.2016

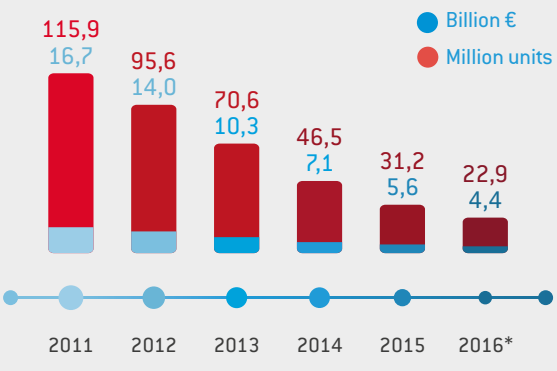
COMPACT SYSTEM CAMERAS (CSC) & DIGITAL SINGLE REFLEX CAMERAS (DSLR), GLOBAL (INCL. NORTH AMERICA)

Value in billion €



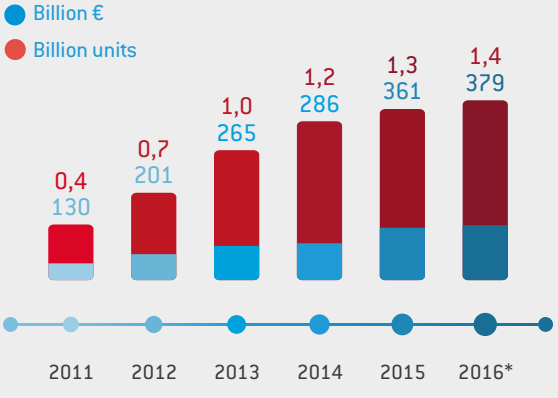
Source: GfK, August 2016
*Estimate as of 08.2016

COMPACT CAMERAS, GLOBAL (INCL. NORTH AMERICA)



Source: GfK, August 2016
*Estimate as of 08.2016

SMARTPHONES, GLOBAL (INCL. NORTH AMERICA)



Source: GfK, August 2016
*Estimate as of 08.2016

Instant photography is experiencing a renaissance. In 2016, the sale of cameras – the media inform us – will top Polaroid's record year of 1991, when 4 million cameras were sold.

APPLICATIONS

More than ever, the idea of having a "camera around one's neck" as the sole concept of contemporary photography is outdated. The imaging world is becoming ever more diverse and, at the same time, is also growing closer together.

Connectivity functions and smart innovations continue to become more widespread. Thus, cameras are becoming a fixed component of the Internet of Things. The idea of "one" camera per user is being replaced by a growing number of capturing devices. High-value cameras are becoming ever more of a lifestyle statement, and specialised capturing technologies are growing more widespread. Cameras, with their initiated reduction to what is essential and an intuitive operability, are increasingly becoming the third eye; they will lead visual communication into new spheres and push language out more and more.

Compact, single-lens reflex and system cameras are now being implemented in high places with ever greater frequency – when they take aerial shots from multicopters instead of the cameras contained in them on delivery. New applications like cameras mounted on a multicopter, moreover, are paving the way for other new imaging technologies. For example, aerial cameras in the future, noticeably, will be controlled via virtual reality headsets.

360-degree cameras, which, likewise, cannot be observed detached from the VR trend, create the requirements for a new kind of storytelling for photos and videos – and they do this without the huge need for equipment like before.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

Well-established camera technologies are continuously being expanded with smart functions, and smart devices are continuously being expanded with camera qualities. Manufacturers of both product categories are cooperating and forming technology alliances that are leading the imaging world into new dimensions. Smartphones with innovative lens constructions and multicopters with medium-format camera units are the first results of this technology transfer. Autofocus technologies are becoming ever faster and more precise. New-fangled techniques, where photo diodes simultaneously process light and measure distance (Dual Pixel AF), are being developed in such a way that they can be used in cameras as well as in smartphones. Photo and video, in addition, are growing ever closer together.

New processes for wireless connections make it possible for images to be transferred via bluetooth without the user even having to initiate it.

After the breakthrough of the 4K standard, the 8K standard, enabling even more detail-rich pictures to be taken, is now in the starting gates. Cameras with more lenses and sensors to improve their scope for details and precision remain in the development pipeline after experience-rich setbacks with pioneering products.

Intelligent software that analyses pictures and also automatically sorts and edits them, moveover, will likely be moved from the browser or the smartphone app into the body of the camera itself.

FORECAST

The transformation of the market for capturing devices will continue to generate momentum. Declines in established categories will be accompanied by growth for new solutions. The networking of cameras and their integration into the Internet of Things are lasting trends that will prompt new growth. In addition, over the mid- to long term, we might experience fascinating new camera form factors. Research is already being conducted into contact lenses with smart cameras or cameras that are similar to eyes with calculating capacities like a human brain. This will not fail on account of the size of the lens: microlenses as thin as a hair are no longer unheard of.

4K Video

Visual Enjoyment of the Highest Art, a Revolution in Snapshot Photography

Ultra-high-resolution video standards are revolutionising visual enjoyment and photography to the same degree. Using new devices to capture and play videos in future-orientated 4K quality is developing into a much-watched trend across all categories and will become the standard in the near future. Moreover, 4K also guarantees pure photography enthusiasts tremendous new creative opportunities on the way to not missing the decisive moment. In addition, technological innovations like 4K call for an ever denser device and software ecosystem that additionally and lastingly animates this trend.

THE MARKET

4K is a fixed component of the marketing strategy of ever more manufacturers and one of the many trending themes of photokina 2016. Whether single-lens reflex or system cameras, action-cams, or 360-degree cameras, smartphones or fancy compact cameras – in all categories users can record films in the 4K standard with more and more high-end and middle-class models. Somewhat delayed but nonetheless noticeable in its spread is the possibility of extracting high-resolution stills from these video recordings.

Filming using capturing devices in 4K is spurring on the accessories market – not only for UHS memory cards with ever higher recording speeds but also in the areas of microphones, lighting and other capturing accessories.

Imaging companies that offer high-resolution television sets alongside capturing devices are further advancing the market for "user-generated content" by means of 4K product bundles. The market penetration of 4K TVs is anticipated to exceed 20 per cent this year (Statista, April 2016), and will also exert a positive influence on the sale of 4K-capable capturing devices.

And in the future, things will get even better because cameras for professional video recordings are already beginning to utilise 8K sensors. In relation to this, so-called "trickle-down" effects can be expected so that 8K cameras will grow more important for consumers within the foreseeable future.

APPLICATIONS

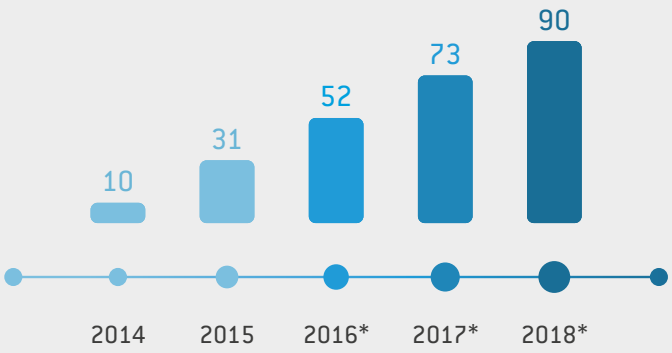
Quality and, thus, visual enjoyment are the demands of YouTube users and especially of the coming generation of videographers, which is why they prefer to rely on single-reflex and/or system cameras for their recording equipment. 4K or UHD videos offer four times as many pixels as the Full HD standard, making the images not only much clearer and more detailed but also allowing for greater contrasts and color nuances. Not only videographers but also photographers profit from the 4K mode, with which they never need to miss a moment. "Superb shots" are losing their status because more and more photographers will be able to extract single pictures from 4K video material. This so-called grabbing technology will become the new standard in all genres of photography, and especially among those whose subjects move very fast. With 8-megapixel resolution, 4K photos are good enough for an A4 extraction.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

Videos and photos are growing closer together with 4K technology and will revolutionise visual enjoyment as well as the way that motifs are captured and lead them into new dimensions. The 8K standard promises to deliver even more detail and enlargement potential. It is already in the starting gates. Some high-quality photo cameras already contain the sensor resolution of 33.2 megapixels necessary for 8K photos. The acceleration of video-capable capturing devices and 4K photography makes it easier for consumers and enthusiasts to gain access to capturing technologies, some of which are very challenging, that were only possible before with significantly more equipment. In this, the 4K trend makes very apparent the advantages of the imaging ecosystem, in which common advances in sensor, processor, computer and display technology as well as on the software side make the further development of videography and photography possible in the first place.

GLOBAL SALES OF 4K / UHD TVs

Million units



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Source: GfK © Statista 2016

*Estimate as of 08.2016

FORECAST

4K technology creates potential for new purchases that enliven the camera market, among others, in lasting ways. The "grabbing" of still shots from videos will become the standard for snapshots in the coming years, and will spur the demand for new capturing devices, memory media and monitors or TVs. This development might gain even more momentum when the 8K standard moves in, which the imaging industry is already working on. However, photography will not die out in favour of filming. The convergence of capturing technologies, though, makes it easier to tell stories in the way most suitable to the situation.

Accessories

Ready for the Next Round of Flight

Superfast zoom lenses, ultralight but sturdy tripods, back-up hard drives with several terabytes of space the size of a business card – these and many other highlights of the accessory market warm the hearts of photographers and videographers. The selection of accessories is so unbelievably large that it could fill a brochure of its own and thus can only be covered on the basis of a few examples. What are the driving forces in the accessory market in the B2C area? More and more people are taking pictures with smartphones, filming with photo cameras and are letting their cameras – mounted on a multicopter – fly. These trends, especially, are generating new buying incentives in the accessory business and are making it much, much larger.

THE MARKET

The accessory market, which itself is driven by innovations but is also dependent on further developments in the imaging workflow with its trends, is getting ever larger and enormously more valuable. The drivers of innovation in this segment, alongside the established imaging companies, are start-ups, which are giving whole new impetus in this branch with their abundance of ideas and causing a furore. Technological worlds will grow closer and closer together and mutually spur one another on because of the rising wealth of facets in the accessory segment.

For example, multicopters are generating momentum; they literally accelerate the demand for diverse components for providing energy, transferring data, assembly and transportation. This segment of the accessory field is currently still too much in its inaugural flight to be to be grasped by numbers.

However, it is obvious that sales of memory cards and video accessories are also profiting from the vertical takeoff of multicopters. These two product categories have been among the rising products in the accessory market for years and, according to PIV and GfK forecasts, will continue to grow in 2016.

The technological development in the field of **memory media** is also impressive. Image sensors with ever higher resolution and the trend toward 4K videos continue to explosively expand the demand for memory and rapid data transfer. The benchmark is 256 GB capacity for Micro-SD cards, double that for SD cards and 4 terabytes for mobile hard drives, but this is surely not the end of the story. High-speed cards with a U3 interface are driving writing/data-transfer speed into a whole new dimension with 90 MB/s. For application purposes that involve a particularly large quantity of data, demanding users reach for the XQD card standard with a PCI Express interface.

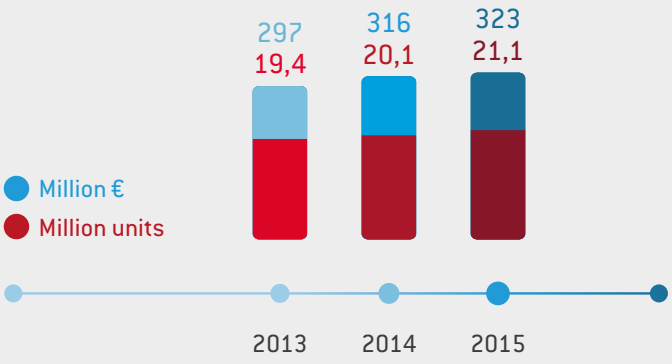
With the triumph of action-cams and the professionalisation of photo cameras for filming videos, **clamps, tripods and rigs** are experiencing a record year. The development in both camera categories has made capturing video in professional 4K quality so easy that it has further spurred the demand for stabilising cameras with stands or hanging devices.

Photo and video accessories for smartphones, including lenses, tripods and lighting devices, also

comprise an obvious growth segment in 2016. A look at the selection of accessories makes clear the trend toward a highly integrated imaging ecosystem just for smartphones. More and more smartphone manufacturers are betting on modular expansions in the form of zoom lenses, 360-degree cameras, grip holders with additional physical buttons and virtual reality headsets. Specialised accessory sellers, too, rely more and more on sets comprised of compatible cases, attachable lenses and grips.

Although the market for **tablet PCs** is declining on the whole, the trend toward mobile computing for photographers runs counter to this. The new category of the so-called 2-in-1 computers – also called detachables – is in high demand, mainly targeting creative professionals. The advantage of these devices, which have the compact size of a

CONSUMER MEMORY CARD SALES IN GERMANY

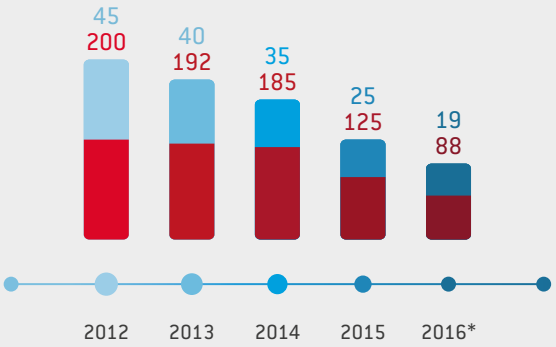


Source: GfK; gfu; BVT © Statista 2016

German consumers purchased an estimated **21 million** memory cards in 2015.

FLASH UNITS, GERMANY

Million € 1000 units

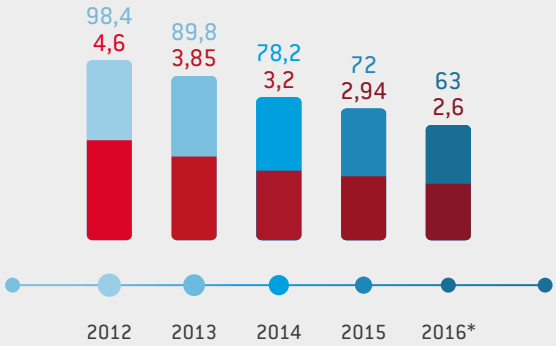


Source: GfK, August 2016
*Estimate as of 08.2016

MARKET TRENDS PHOTO AND IMAGING ACCESSORIES IN GERMANY

CAMERA BAGS, GERMANY

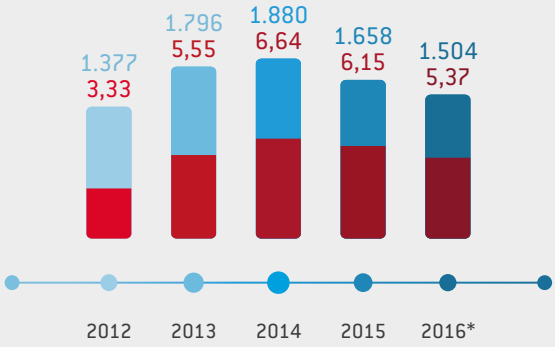
Million € Million units



Source: GfK, August 2016
*Estimate as of 08.2016

TABLETS-PCs, GERMANY

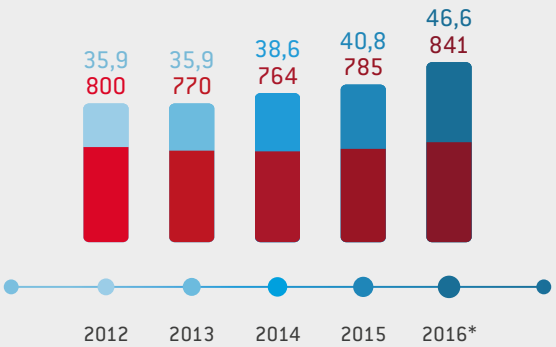
Million € Million units



Source: GfK, August 2016
*Estimate as of 08.2016

TRIPODS / VIDEO RIGS, GERMANY

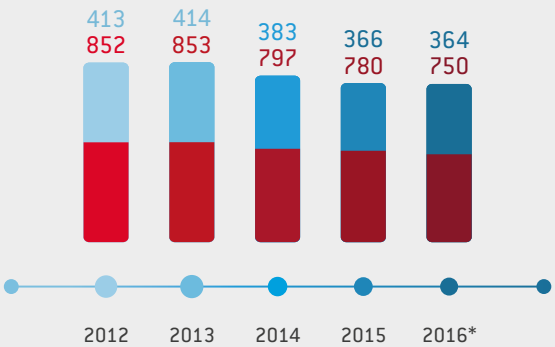
Million € 1000 units



Source: GfK, August 2016
*Estimate as of 08.2016

LENSES (AFTERMARKET), GERMANY

Million € 1000 units



Source: GfK, August 2016
*Estimate as of 08.2016

tablet PC and the performance-capability of a full-fledged laptop, is that pictures or videos can be viewed, edited, and sent to those who commissioned them on site. Since, generally speaking, these are well-equipped, high-priced products, the potential for added value is great.

The production bottlenecks for capturing devices caused by the Kumamoto earthquake carry over to some extent into the accessory market as well. This is because the sale of cameras is closely tied to the aftermarket. Therefore, the sale of lenses (aftermarket) for cameras with interchangeable lenses will develop along the same lines as the camera market. The same is true of **flash devices, photo bags and photo backpacks**. By 2017, these product categories might have restabilised if camera production resumes at its usual level.

Software for image editing, according to John Peddie Research and Statista (July 2016), will remain a growing billion-dollar industry for years. Fee-based programs are primarily a market for professional users. An ever more diverse array of mobile software is available to consumers. In-app purchases provide access to more functions, cloud storage or the possibility of synchronising between mobile devices and desktop computers. That holds significant potential for added value in the B2C field as well.

APPLICATIONS

New product categories for capturing devices are setting trends that are also shifting the accessory market into the smart age. Only when they have the necessary accessories can photographers and videographers completely utilise the possibilities new applications provide. Taking aerial photographs with multicopters is evoking ever more interest. Whoever wants to create panorama shots simply and easily now turns to the new category of 360-degree cameras. VR glasses provide users with an especially immersive viewing experience when looking at the pictures. Hybrid computers built on the 2-in-1 principle make it possible for users to engage in professional image editing despite having little luggage even when they are out and about. The quantity of data is becoming immeasurably large – according to IDC, it will grow to 44 billion gigabytes by 2020. Smart solutions with ever greater capacities and a high degree of security will become the standard.

> "In the smartphone sector a trend towards an independent imaging ecosystem is becoming apparent, for example in the form of modular accessories, such as zoom lenses, 360-degree cameras, grips and VR headsets."

THE CONTRIBUTION OF THE IMAGING INDUSTRY

The accessory market is an excellent example of the interaction in the imaging ecosystem, as exemplified by the cooperation between camera and multicopter manufacturers who provide users with the possibility of high-quality, ready-to-use total solutions comprised of flying and capturing devices. The cooperation between smartphone specialists and optical companies in the case of attachable lenses likewise builds a bridge between the digital imaging and the smart imaging worlds. The fact that photographers and videographers increasingly consider tablet PCs a self-evident part of their gear shows how much imaging and IT are increasingly intertwined.

FORECAST

The development of the accessory market will continue to be tied to the imaging workflow. As the latter continues to expand, this is reflected in a greater range of possibilities. The form in which the digital transformation progresses toward the smarter imaging world will have an effect on the portfolio of the accessory market. The accessory segment will increasingly derive additional impulses that also stand for future visual trends from the start-up scene, as well as from the trend toward integrated system solutions within the imaging ecosystem.

87 per cent of globally sold VR headsets are for smartphone use (only 13 per cent are for PCs or gaming consoles).

By 2020 global sales of VR headsets will increase to **64.8 million** units.

Source: Strategy Analytics, IDC

Virtual Reality and 360-degree Pictures

Everything Is So Nice and Round

Virtual reality (VR) is turning more and more people's heads and is one of the trending topics of photokina 2016. With computer glasses for virtual reality, people dive into artificial worlds, they enjoy visual holiday memories in a new way from the centre of the scene, or, for example, put together aerial shots directly from the viewpoint of the camera multicopter. Simply by moving their heads, users control what happens and experience it as though they were physically present in the scene. The start of virtual reality was rocky, but now the market is expanding as the possibilities have been further developed, and it is growing dynamically. And it is the imaging companies that are laying the foundation for these new-fangled visual experiences with displays, lenses, sensors and software solutions as well as by cooperating with start-up companies.

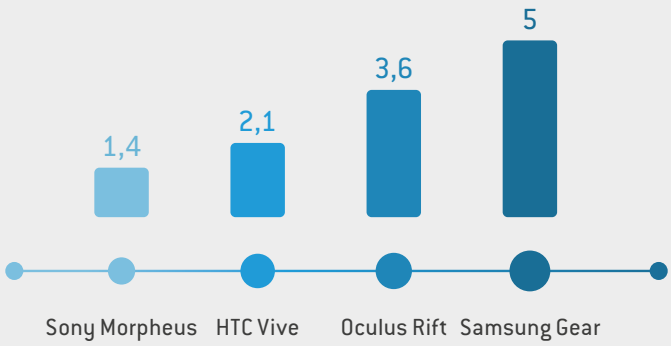
THE MARKET

The most well-known VR headsets are high-performance models with integrated displays and sensors for head control, connected to a PC or video console with a cable. However, with 13 percent of the total market worldwide in 2016, their share is fairly small. VR mounts with magnfication lenses, for which smartphones serve as the central display and computing unit, are much more significant (87 per cent, Source: Strategy Analytics).

All in all, IDC forecasts sales of almost 9 million VR headsets worldwide in 2016. By 2020, annual sales could increase several fold, reaching 64.8 million units. Other market researchers anticipate similarly high growth rates. SuperData Research is predicting a boom: From 3.7 billion US dollars in 2016, worldwide sales might rise to 40.4 billion US dollars in 2020.

SALES ESTIMATE 2016
VR HEADSETS, GLOBAL

Million units



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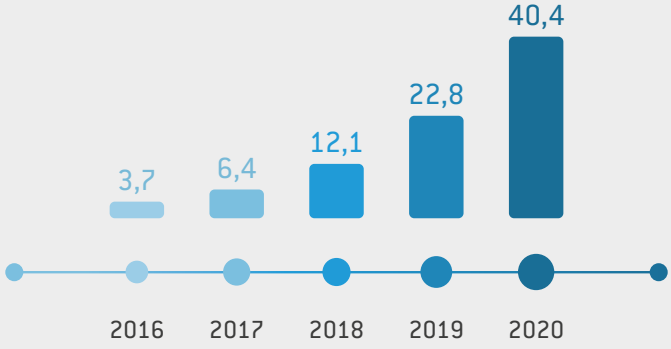
Source: Piper Jaffray © Statista 2016

ESTIMATE VR MARKET
SOFT & HARDWARE, GLOBAL

Value in billion US $



© 2016 Photoindustrie-Verband (PIV) as of 08.2016
Source: SuperData Research © Statista 2016

In Germany, too, virtual reality has arrived. According to Bitkom, every tenth German (9 per cent) over the age of 14 has already tried out a pair of VR glasses. And in the summer of 2016, in addition, one third (31 per cent) of all Germans can imagine purchasing a headset. The previous year it was still only 20 per cent.

APPLICATIONS

Virtual reality makes it possible to have new-fangled viewing experiences – beyond gaming and entertainment films. A virtual panoramic view can make selecting a holiday destination or the configuration of a new car easier; it can add to the excitement of a rollercoaster ride at the amusement park, or ensure one of a front-row view at a live concert. Photographers and videographers, too, profit from new points of view. For example, currently a new and fascinating genre of pictures is becoming established involving VR-compatible panoramic shots. 360-degree pictures present the atmosphere on a mountain peak, in the middle of skyscrapers or in blooming gardens in an especially vivid way. VR technology, moreover, expands photographers' and filmmakers' creative scope; they no longer have to limit themselves to telling just a small excerpt from a story. Photos and videos in 360-degree format allow them to present far more detail, plot lines and surprising twists.

Taking VR 360-degree pictures can already be achieved with various amounts of effort using traditional capturing devices. Because the growing genre is also prompting new trends in the camera market, we will no doubt see a great variety of new, specialised products in the future that will extend beyond the already available array of 360-degree cameras.

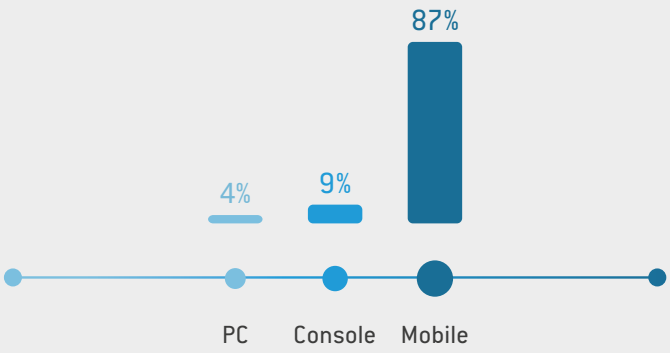
THE CONTRIBUTION OF THE IMAGING INDUSTRY

To have successful virtual reality experiences, the product expertise of many specialists is required. On account of the presentation so close to the eye, display units are crucial; they need to present as much detail as possible in the smallest possible space so that individual pixels can no longer be discerned. VR headsets with magnifying lenses, despite all the electronics, still demand solid optical know-how. In order to minimise the typical distortions caused by the principles of 360-degree shots, high-quality lenses, sensors and image processors are indispensable. Software that simplifies the processing of VR and 360-degree panoramas is another growing sphere of activity for imaging companies.

FORECAST

The more familiar and widespread virtual reality glasses become, the more the available array of hardware and software for them will grow. Almost

ESTIMATED VR HEADSET SALES SHARE 2016, GLOBAL



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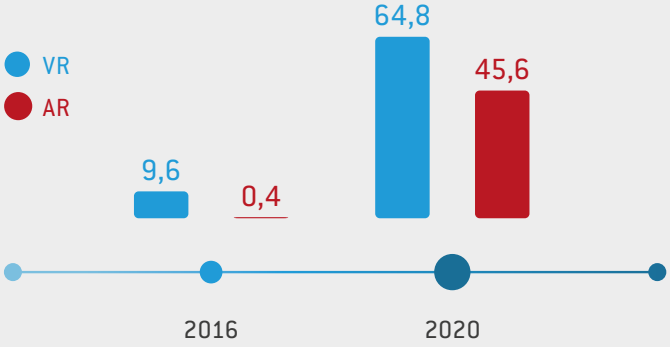
Source: Strategy Analytics © Statista 2016

SALES ESTIMATE VR AND AR HARDWARE, GLOBAL

Million units



© 2016 Photoindustrie-Verband (PIV) as of 08.2016
Source: IDC © Statista 2016

every day manufacturers announce new headsets, cameras, games, functions and applications that were developed from the start for the VR panorama experience. Soon virtual reality will be firmly anchored in the repertoire of many photographers and videographers. The imaging industry is actively contributing to bringing this fantastic new world ever more to life.

THREE MARKET STRATEGIES FOR VIRTUAL REALITY GLASSES

Virtual reality glasses are the key product of this new market. Three types of products have become established. **Mechanical glasses for mobile VR** comprise the entry-level segment. They do not contain any electronic components. Smartphones serve as the display as well as the computing unit and are mounted in a slot in the field of vision. Magnifying lenses close to the eye enlarge the content of the display. The sensors integrated in the smartphone transform head movements into action. For practically all current smartphones a mechanical glasses model is available. Variants made of cardboard are available for about 10 euros.

Located in the mid-range price segment, **electronic glasses for mobile VR** utilise additional sensors and buttons for more precise control. These models, available starting at about 100 euros, are optimised for selected smartphones to make sure the technologies work together well.

Stationary VR glasses are not for mobile use. Their integrated displays receive image signals via a cable connection to a PC or a console. This high-end solution makes much greater computing power possible than mobile VR. This technology is particularly exciting to demanding videogamers who are prepared to spend several hundred euros.

Pictures: Mr. Cardboard, Samsung, Oculus

Augmented Reality

All Signs Point to "Go!"

Augmented reality (AR) is virtual reality's little sister. Unlike with VR glasses, AR users do not dive into artificial worlds with their entire field of vision. Rather, their view of the environment is expanded with useful computer data presented on the smartphone screen, the glasses lens or the windshield. This future-orientated market is starting to take shape after a short breather; it will enrich the lives of many consumers in diverse and fascinating ways. With high-performance data glasses and new-fangled applications, the imaging industry is actively advancing this mega-trend.

THE MARKET

Data glasses for AR applications have been a niche segment in the past few years. After experience-rich setbacks with pioneering products, the technology now seems ripe for a breakthrough onto the mass market. Whereas about 400,000 AR headsets are expected to be delivered worldwide in 2016, this is predicted to be 45.6 million devices in four years (IDC, April 2016). Those who drive a new car rather than go on foot may see a head-up display in the front windshield much more often in the future. In 2021 an estimated number of six million vehicles will be delivered with an HUD. That exceeds 2015 by 65 per cent. (IHS, December 2015). Because the partially transparent AR hardware, in principle, can be used more flexibly in more areas than the fully wired VR headsets, augmented reality could be the more important product segment, economically speaking, in the medium term. Digi-Capital (January 2016) predicts worldwide augmented reality sales of 90 billion US dollars for 2020, whereas virtual reality in the same period is estimated to generate sales of only 30 billion US dollars.

Different from VR, moreover, the future of the market for AR software is not even tied to additional hardware sales. That is because the technological infrastructure is already available in most households. Many AR applications can be utilised on today's standard smartphones. This explains the explosive success of the augmented reality based games app Pokémon Go.

APPLICATIONS

The developers of AR glasses are currently focussing on business applications. But consumers can now already find a variety of apps for smartphones that are relevant to daily life. Computer games for out in the open are currently especially popular. Photographers and videographers can simulate different sun positions and thus plan optimal light conditions in advance. For furnishing a flat, one can project virtual pieces of furniture onto the real wall. Image service providers can use the relevant apps to visualise how enlargements in XXL format would look in customers' homes. Tourists can get tips on sights, transportation stops and restaurants that they can view through their smartphone camera. Already 59 per cent of all users of an AR app in Germany, Great Britain, France and the USA look for a company or product in this manner (Adobe Mobile Consumer Report, October 2015).

Looking into the future, software for data glasses users could simplify the computational work. Several companies are working on virtual desktops. With these, photographers and videographers, for example, can use AR glasses to cast as many virtual computer surfaces on the wall and swipe image files with finger gestures from one screen to another. An elaborate multi-monitor set-up would no longer be necessary for this. This would be practical on trips.

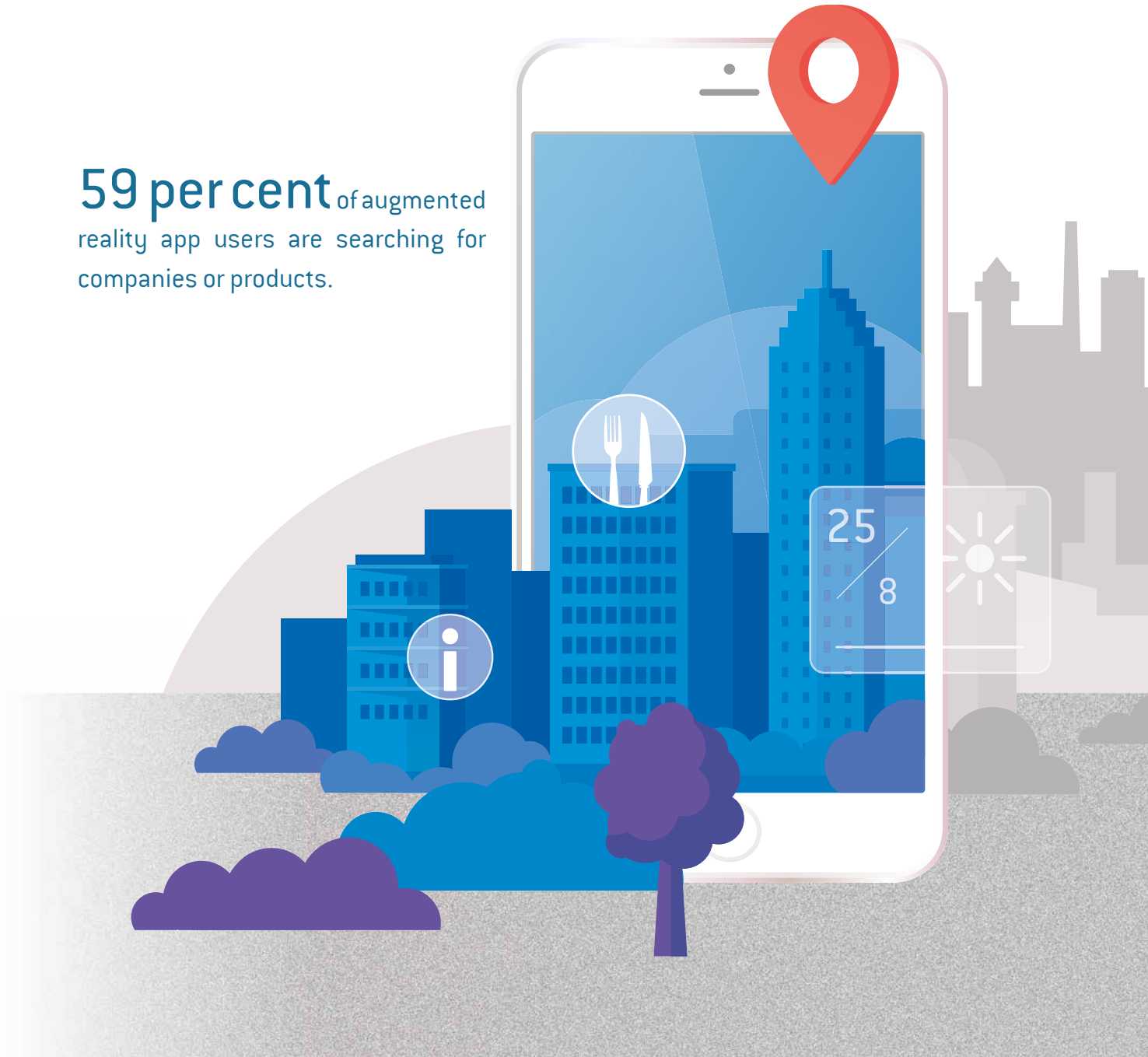
THE CONTRIBUTION OF THE IMAGING INDUSTRY

As with VR glasses, the interplay of several components is central to the functioning of augmented reality data glasses as well. Hybrid visual aids with precise optical characteristics are needed for trouble-free transparency as well as bright and high-contrast displays with the highest possible resolution for blending in the digital information. To keep the weight low and comfort of wearing high, manufactuers are optimising the choice of materials and are utilising new-fangled OLED displays, for example, made of silicon instead of glass. Imaging companies are entering into new fields beyond the hardware business and cooperating with software studios. New types of applications are arising in this process that will enrich both private and professional life in noticeable ways.

FORECAST

The AR market is in an earlier phase than virtual reality, and its dynamics will emerge somewhat later but presumably in larger leaps. In the short term the most important developments can be expected in the field of professional customers. In the medium term, however, one can anticipate that there will be more AR hardware that will be optimised for the needs of consumers.

59 per cent of augmented reality app users are searching for companies or products.



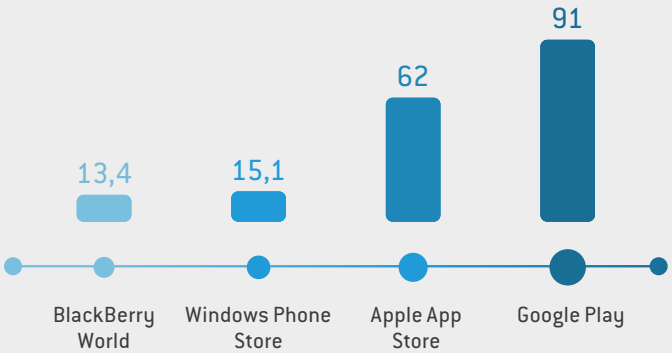
Apps

Billion-dollar Market of Mini-Programs

Although apps are the mini-version of computer programs, they present tremendous potential for innovation to the imaging world. They open the door to new technologies, and inspire photo and video enthusiasts to make use of augmented reality, picture editing via artificial intelligence or aerial shots with multicopters. As a tool for brand development, they spark the interest of new target groups and build a bridge between traditional and smart photography. Thus, it is hardly surprising that the app market is booming.

DOWNLOADED APPS
BY APP STORE, GLOBAL

Billion downloads



 as of 08.2016
Source: Statistic Brain Research Institute © Statista 2016

THE MARKET

The most important market places for mobile applications are still the Apple App Store and the Google Play Store, each with about 2 million available apps. Up to today, they have registered 153 billion app downloads (Statistic Brain Research Institute, June 2016). In terms of their reach, Google is continuing to advance beyond Apple: By now, users download an Android app twice as often as one for iOS. As far as money is concerned, however, the opposite is true. At half the dowload rate, Apple's platform generates twice as much sales volume (App Annie, July 2016).

Selling applications, content and services in app form continues to be an attractive market. Whereas, according to market analysts from App Annie, sales in this segment amounted to 41.1 billion US dollars worldwide in 2015, for the current photokina year sales are estimated to reach 50.9 billion dollars. By the end of the decade, this value will double, App Annie predicts (February 2016).

The demand for apps for mobile devices is rising rapidly in Germany, as well. According to Bitkom and research2guidance (August 2015), the market here in Germany might have broken past the billion mark in the past year. Thus, they estimate that sales amounted to 1.3 billion euros, 41 per cent more than in 2014.

Applications for photos and videos have a solid position in the app economy. Pocketgamer (June 2016) attributes over 53,000 apps to this category in the Apple App Store, and Appbrain (July 2016) counts more than 39,000 at Google Play.

Demand and sales volume, however, are not one and the same. According to App Annie, measured by downloads, imaging apps were the most popular category in the second quarter of 2016 at the Apple

App Store; at the Google Play Store, they were the third most popular. In the sales ranking, however, this category only landed in ninth place in the App Store and not even in the top ten in the Play Store. The fact that many apps can, in principle, be used for free might have contributed to this. Moreover, many traditional imaging companies use apps as a tool for brand development that is free for customers. The relationship between downloading rates and sales, however, also shows the potential that the monetisation of apps for photos and videos still contains.

APPLICATION AREAS AND THE CONTRIBUTION OF THE IMAGING INDUSTRY

As the number of photo and video apps grows, the wealth of different features and innovative spirit grow as well. Applications for controlling cameras, for editing filters and effects, retouching, photo collections in the cloud, mobile printing, generating photo albums, calendars and greeting cards have become firmly established.

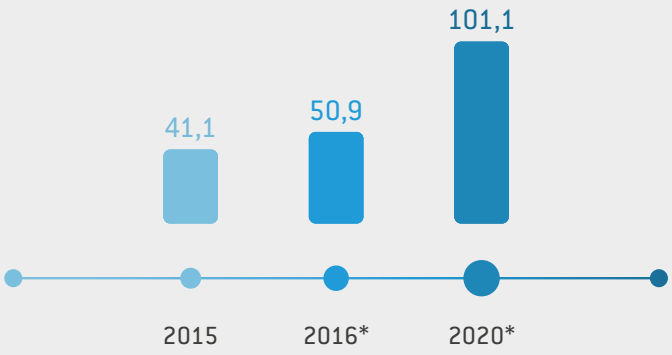
In addition, well-known imaging software manufacturers are generating more and more apps with professional functions for mobile devices so that complex photo and video projects are no longer reserved for the desktop computer. At the same time, Internet-based mobile applications for smartphones and tablets are increasingly simplifying technologies that could previously only be implemented with great effort and expense. For example, apps, nowadays, can replace the broadcasting van and make it possible to broadcast videos as a live-stream in no time at all. There is a steady flow here in the intertwining with social-media applications.

Moreover, apps, meanwhile, are often the preferred method for introducing new imaging technologies on the market. In order to organise the steadily growing picture collection on one's mobile device, new-fangled, intelligent administrative apps can sort them by means of self-learning algorithms. Apps for taking pictures and editing them use cloud computing and artificial intelligence to automatically improve the results.

And when new imaging hardware comes onto the market, the app increasingly accompanies it as a central controlling unit that simplifies the interaction with devices considerably. Practically all the current

MOBILE APP SALES, GLOBAL

Value in billion US $



Source: App Annie © Statista 2016

*Estimate as of 08.2016

camera models have been designed for connectivity and can be operated via Wi-Fi and Bluetooth by means of an app. Instead of controlling photo drones with remote control or 360-degree cameras with physical buttons, users can now often simply use a smartphone app instead.

FORECAST

Along the lines of mobile devices developing ever higher performance, the category of photo and video apps has also continued to develop various imaging software types that can be used by professionals. Mobile apps are a billion-dollar industry and, meanwhile, have become customers' first choice much of the time for interacting with new imaging devices, applications and services. This trend will continue in the coming years. Established imaging manufacturers will successively expand their selection of mobile offers, and in the future start-ups will "think in apps" even more often from the very beginning.

Optics for Household Robots

To Read Wishes Good Eyes Are Needed

They go the extra mile for a spot or a dust bunny, and they are never too tired to play or read a good-night story – household and entertainment robots are becoming popular housemates. Without high-quality 3D cameras, image algorithms and displays, however, they would not be able to do a thing. Thus, service robotics is a big future topic for the imaging industry.

THE MARKET

Just as a good service robot remains as inconspicuous as possible but is nonetheless ever present, the market, too, has developed into a billion-dollar industry without any big fuss. According to the International Federation of Robots (IFR), in 2014, about 4.7 million service robots were sold for private use – 28 per cent more than in 2013. Sales volume increased in 2014 to 2.2 billion US dollars. The numbers for 2015 were not available by the publishing deadline.

Devices that many people would not even commonly refer to as robots comprise the largest group. Around 3.3 million autonomously operating vacuum cleaners, lawnmowers and window washers

were sold around the world in 2014 for 1.2 billion US dollars. Entertainment robots are still in the minority with 1.3 million sold units, but they are increasing rapidly. Turnover increased by 40 per cent compared to 2013. Many of them can be placed in the toy segment, but they exhibit a broad range, from inexpensive entry-level products to programmable devices of a high-tech character. In the course of increasing home automatisation and ever smarter home electronics, entertainment robots will also increase their presence in households with a wealth of multimedia functions.

For 2018, the IFR predicts worldwide sales of almost 26 million household robots as well as 9 million devices for entertainment and education. The German market, too, may contribute to this growth. According to one study by the credit bank CreditPlus (September 2015), 72 per cent of Germans can imagine purchasing a robot as household help. Among young Germans below the age of 35, it is even 85 per cent.

APPLICATION AREAS

At the moment, service robots that take care of burdensome household and garden tasks for their owners are very popular: They clean the floor, wash the windows or mow the grass. A grilling robot that turns and serves the bratwurst has not yet reached market-readiness. But this use is just as conceivable as many others. Announced multimedia robots could already read cooking recipes or good-night stories aloud in the year 2017; they could control Smart Home applications or call for help if a resident has an accident. Security and surveillance robots are already being tested in pilot projects. Robots that assist people with physical disabilities are regarded as a future market of the next 20 years.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

For service robots to function properly without getting stuck in a corner, falling down or missing when they reach for an object, and, in case of doubt, to correctly assess what they see, they need reliable sensors. In certain situations, cameras that can measure depth or analyse visual informatoin are superior to other measuring procedures. Touch displays for viewing content or controlling the robot comprise another important component. All of these things touch on a key segment of the imaging industry, so that the industry has a large role to play in the progress of robotics. The market is experiencing dynamic development and is attracting many new players from related industries. It is also motivating companies to take up development projects that they had temporarily put on hold.

> "72 per cent of Germans can picture themselves purchasing a robot."

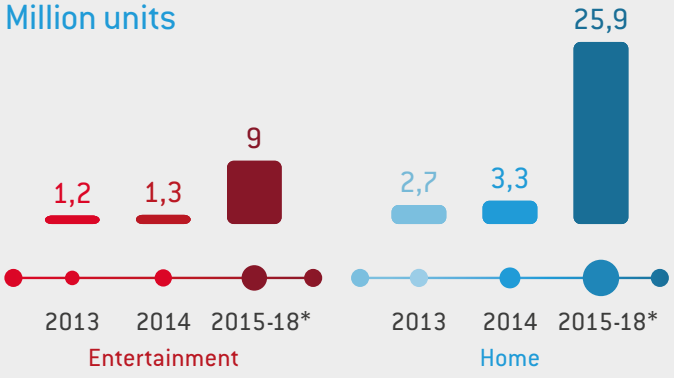
FORECAST

Household and entertainment robots will increasingly change and enrich people's lives; they will also be much more present in daily life in the future. Some of them may have humanoid traits and stir emotions. Yet despite some research efforts, universally usable assistants so similar to humans that they could be mistaken for them remain a pipedream.

SALES OF SERVICE ROBOTS FOR HOME AND ENTERTAINMENT, GLOBAL

PIV WE ARE IMAGING

Million units



Source: IFR © Statista 2016

*Estimate as of 08.2016

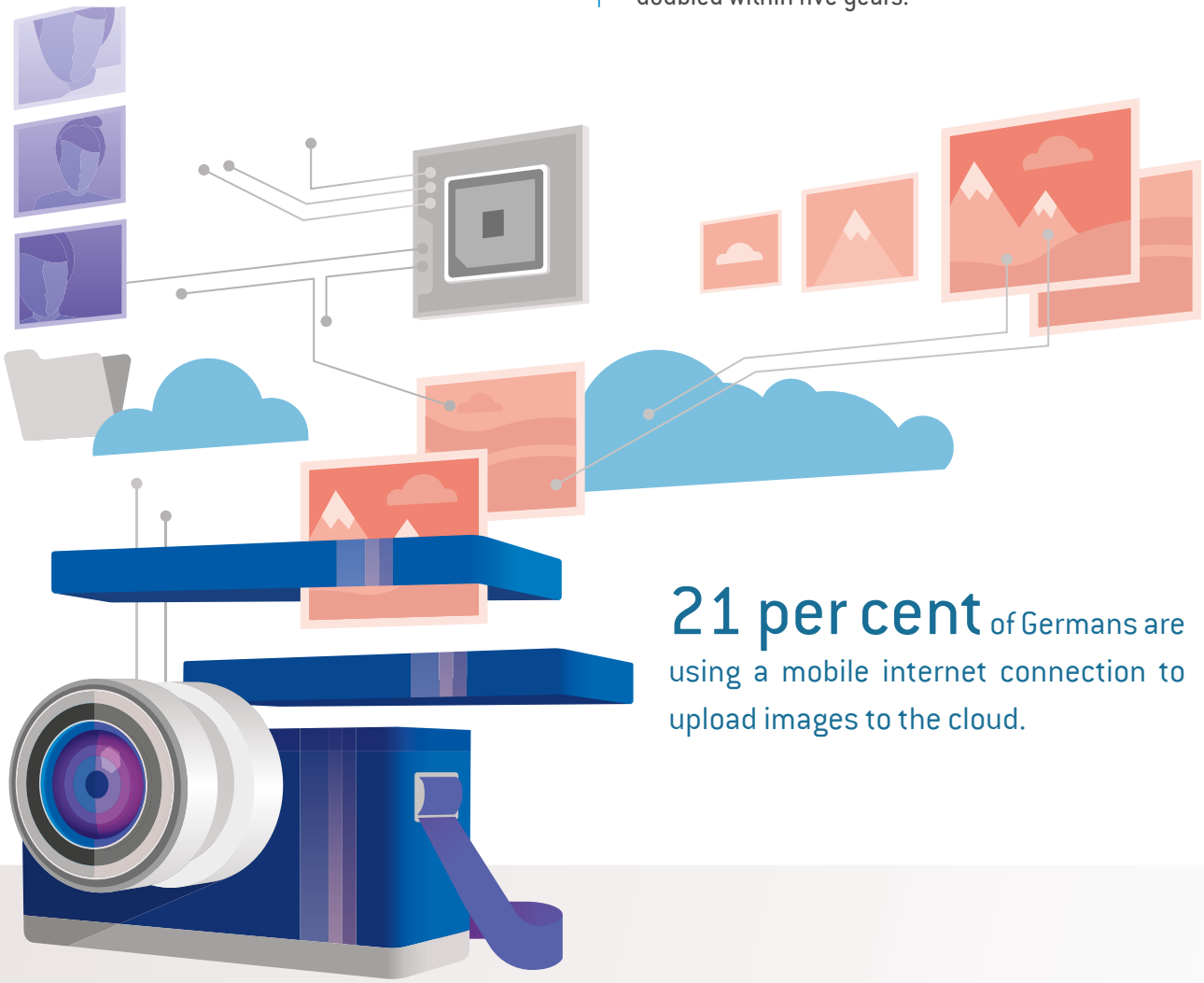
Cloud Computing

The Connected Imaging World

To edit, sort, and archive photos via the cloud is becoming a common practice. Creating efficient workflows via networking and intelligent solutions is a central theme of the imaging industry. More and more providers are connecting capturing devices, peripherals, software and web services to an imaging ecosystem with endless creative possibilities and an eye to ever more reliable data security.

THE MARKET

With the growing number of pictures and new trends including 4K and slow-motion videos, the need for storage space is growing rapidly, finding expression also in physical storage media with ever greater capacities. Only cloud solutions guarantee data security and the ability to access picture data from anywhere, independent of a particular device. Currently, intelligent solutions with automatisations that are revolutionising the way picture data is stored, edited and transferred stand at the forefront of innovations. The cloud is growing worldwide. According to a Gartner study (January 2016), the sales volume of cloud services for business and private customers will reach about 203 billion US dollars in 2016. Thus, business will have more than doubled within five years.



21 per cent of Germans are using a mobile internet connection to upload images to the cloud.

According to a Eurostat survey (December 2015), 23 per cent of all German consumers use cloud services. Young people aged 16 to 24 accept the Cloud better than the older generation. Every third (33 per cent) already uses the data cloud. Among 25- to 54-year-olds, it is every fourth person (25 per cent).

Studies suggest that photo enthusiasts have long since moved beyond using stationary computers to access the cloud. Already 21 per cent of Germans use their smartphone's connection to the Internet in order to upload photos and other data to cloud services, for example (Initiative D21/ ipima, July 2015). Almost two-thirds of all Germans over the age of 14 (63 per cent), according to Bitkom (October 2015), share photos in social networks by smartphone.

Not every photo that lands on a smartphone was taken with it. The smartphone, among other things, sometimes merely serves as a link between the Internet and the possibilities of generously equipped single-lens reflex, system, and compact cameras. Although "Connected Cameras" have not yet established themselves as an independent category, they have become a reality. Across all camera categories, high-end and mid-range models now have Wi-Fi or bluetooth connectivity as a standard feature. Depending on the camera model, photos can also be saved to the cloud directly via a Wi-Fi connection.

APPLICATION AREAS

By now, Cloud Computing presents as many varied possibilities as working on a traditional computer. Along with security, sharing pictures and exhibiting them on connected screens of all sorts, editing functions are increasingly becoming a focus. Millions of users now rely on cloud-based workflows in order to edit their photo collections on different devices and to transfer the changes automatically to all the saved copies of the data on individual devices. The next step has already been taken. First, picture applications are image applications are run locally, but then the actual computing operations are managed over a cloud server. In this way, users can utilise the algorithms of self-learning software that require great computing power. This makes it possible to carry out standardised but elaborate picture editing in an automated way. Computer-supported intelligence is managing the tedious work of sorting photo collections for users.

> "In the cloud the laborous task of image sorting is taken over by artificial intelligence."

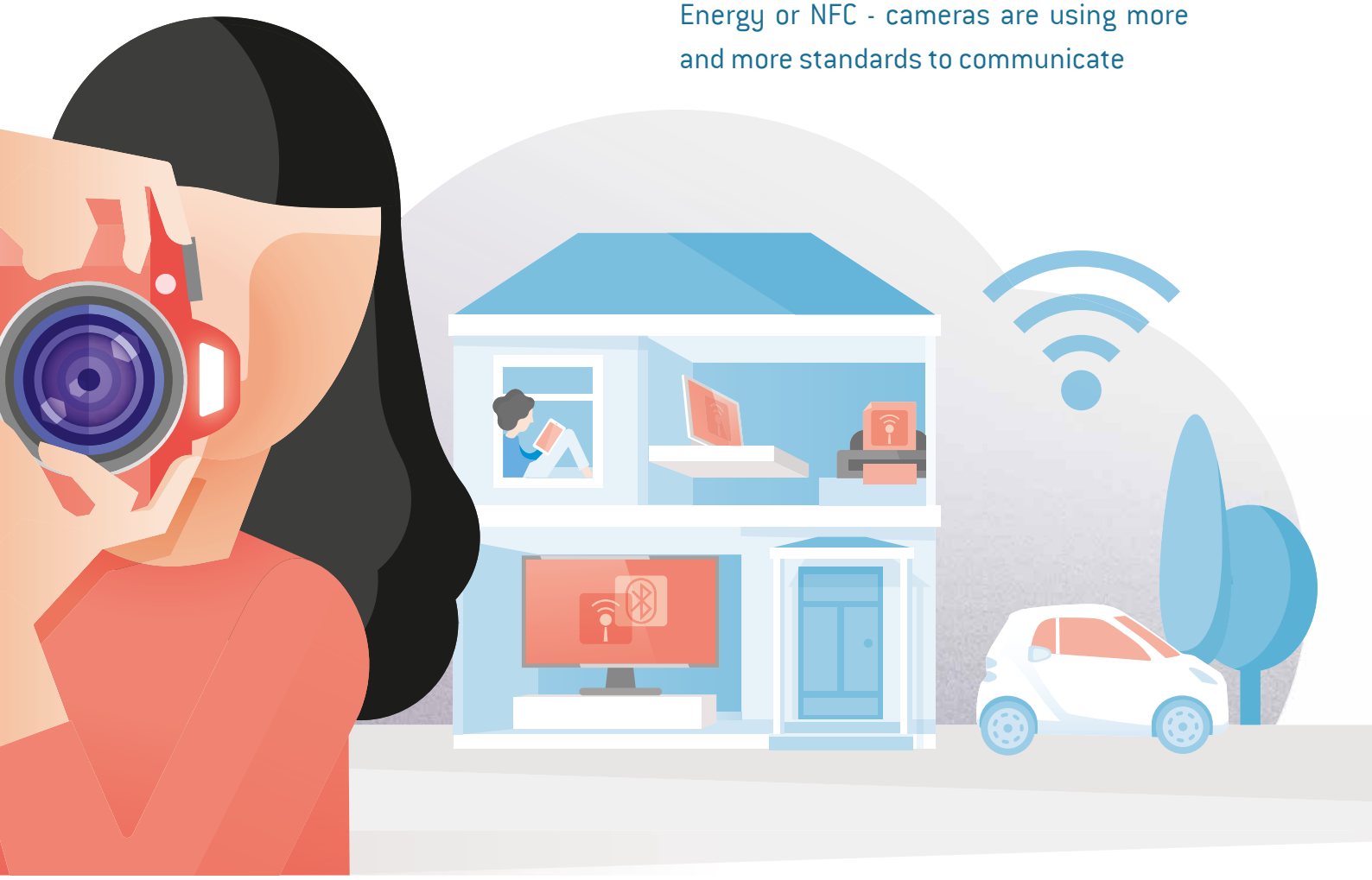
THE CONTRIBUTION OF THE IMAGING INDUSTRY

Along with the development of hardware, software and services, the connecting of all of these things within the framework of the imaging ecosystem is taking up ever more space in the imaging industry. Cloud Computing comprises the link in this, making many innovations possible in the first place. A growing number of imaging companies, meanwhile, are now successfully offering one or several cloud-based services with different aims themselves. Storage capacities and smart functionality are successively being expanded in this process. By connecting capturing devices, printing, home electronics and social media via the cloud, the imaging industry extends the creative possibilities of capturing images, editing them, saving them in a secure way, as well as managing and presenting them.

FORECAST

Photography has long since become digital. Thanks to connectivity with cloud services, it will become much, much smarter. With new applications and functions, consumers can increasingly outsource not only storage components but also computing capacities in the data cloud. This makes it considerably easier to create high-quality photos and videos for broad groups of customers. This is an added value that will revolutionise the imaging industry and generate new potential for even more value creation by increasing demand.

Wi-Fi, Wi-Fi Direct, Bluetooth Low Energy or NFC - cameras are using more and more standards to communicate



Connectivity

Wi-Fi Has Taken Off

The multiple meanings of "connectivity" as a connection or the ability to link things together expresses the relevance of this option. The imaging industry is further advancing the connectivity of capturing devices and their integration into the imaging ecosystem. Photographers and videographers profit from this by gaining new creative possibilities and more efficient workflows.

THE MARKET

The connected camera has now become a reality. Across all camera categories, more and more models are now equipped with Wi-Fi for the wireless transfer of data and control signals. You don't have to be a fortuneteller to see that this feature is increasingly becoming a standard one. The market penetration is proceeding rapidly, according to GfK. Whereas in 2012, when smart cameras were first generating broad interest, only three per cent of all models available were equipped with Wi-Fi capabilities, by mid-2016 the number had already grown to almost 40 per cent. The proportion of connected cameras, however, is considerably higher. If they do not

already contain an integrated Wi-Fi module, they can be connected via Wi-Fi-capable memory cards.

The imaging industry has not further pursued additional possibilities for equipping SLR-, system and compact cameras with Wi-Fi using a SIM card. Soon this feature could once again become an important camera form factor when the first multicopter models are introduced to the market with a 4G connection.

APPLICATION AREAS

The range of Wi-Fi functions is rather varied across different camera models. Some communicate only with a smartphone or tablet; other cameras can be connected directly to the Internet via a Wi-Fi hot spot. More and more current camera models also offer the option, besides the usual Wi-Fi function, of pairing devices via NFC (Near Field Communication).

Allowing cameras to connect automatically and controlling them remotely via app over mobile devices are options that significantly add value. For example, when capturing videos or photos at night, these options can be used to avoid vibrations or if photographers wish to be in group pictures themselves and wait for the right facial expressions via Live-View on their smartphones. Thanks to Wi-Fi, photos and videos can then also be transferred and saved to smartphones and tablets if no card slot or adapter is available. With editing apps, users can edit their images right where they are and share them in a social network. Depending on the scope of functions, a camera can be connected to a Wi-Fi router. This allows photos to be directly uploaded to cloud storage, transferred to a Wi-Fi printer or wirelessly presented on a smart TV.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

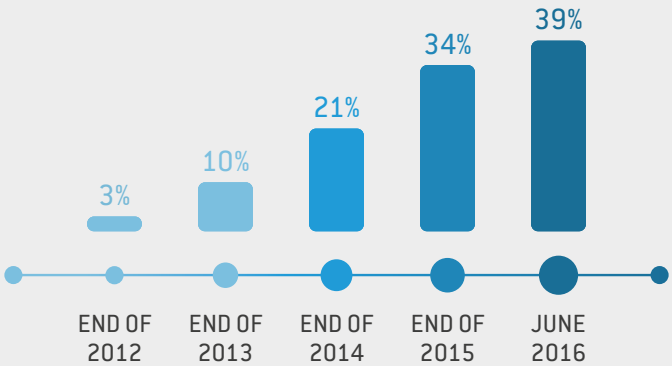
By developing even more intuitive processes for transferring pictures, the imaging industry is actively advancing the topic of connectivity; it is also creating smart solutions that add considerable value and, thus, is continuing to generate new purchasing incentives. For example, supplementing Wi-Fi with the energy-saving wireless standard Bluetooth Low Energy has now made it possible to establish long-lasting connections between cameras and smartphone apps. This enables the photo transfer process to take place continuously while users are still taking pictures. When they pick up their mobile device, the photos will already be ready to send into the social media gallery.

> "In 2016 40 per cent of all cameras available in retail come with a built-in Wi-Fi module. Four years earlier it was only three per cent."

FORECAST

Along with connecting smartphones and tablets, integrating cameras into Smart Home functions will become even more important in the future. Transferring a picture from a capturing device directly to the refrigerator display could soon be a matter of course.

CAMERAS AVAILABLE IN RETAIL WITH BUILT-IN WI-FI, GERMANY



Source: GfK, Juli 2016

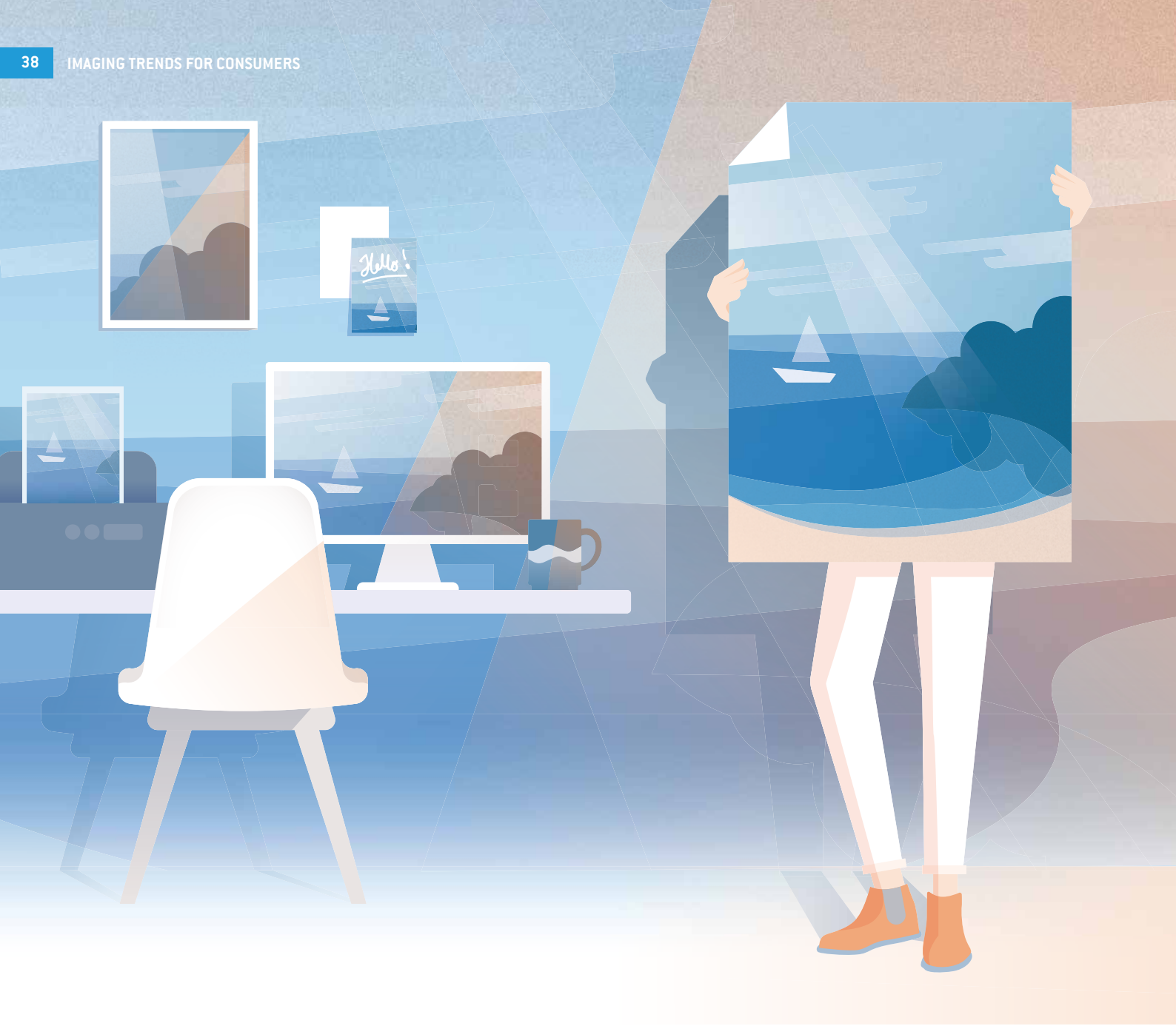


Image Output

Printouts in No Time

Photographed with skill, masterfully perfected – and then? Pictures need to be presented – digitally and physically. Mobile Services and apps offer always new and inspiring possibilities for sharing and exhibiting photos and videos. In the smart imaging world, too, haptic experiences remain popular. The selection of printable materials and formats is constantly growing. The trend toward classics like self-designed photo wallpaper is ongoing. Printing images on large textile surfaces is becoming more significant. Smart processes like connections to augmented reality and video are becoming more present. Web-to-print, live-streaming and 3D printing are generating more new sales potential in the medium term.

THE MARKET

The output market is multi-layered, with each of its individual pillars having immense value on its own. It would take a whole brochure in itself to be described properly, which is why what follows primarily only delves into the B2C segment, including image services as well as photo printers.

For example, for one thing, the output market feeds off of devices ranging from smartphone photo printers and large-format printers to photo kiosks, mini-labs, or, say, printers for image service providers.

Another large pillar is comprised of the extensive selection of image services that can be provided including photo albums, photo enlargement up to the XXL format, as well as the entire range of photo merchandise. Since photos on paper are the longest lasting way to archive images, it is a good choice for the long term from a consumer perspective.

The imaging industry is also involved in the meaningful market for packaging, which is far more than mere boxes or wrappers. The creative and culture industry cannot be ignored – it uses imaging print solutions just as much as retailers, who increasingly employ them to retain customers.

The printing media in themselves are, of course, essential for output, and thus for the imaging market. In relation to paper, textiles, transparencies, glass or porcelain, it is imaging companies that occupy this market and advance it with their innovations.

Image service providers are continuing to expand their market relevance thanks to their forethought, their innovative capacity, but also thanks to the array of smart solutions they can both playfully and simply present to users via Internet-based games. These games, which are reflected in the variety of offers, certainly also play a crucial role in these service providers understanding how to retain young customers.

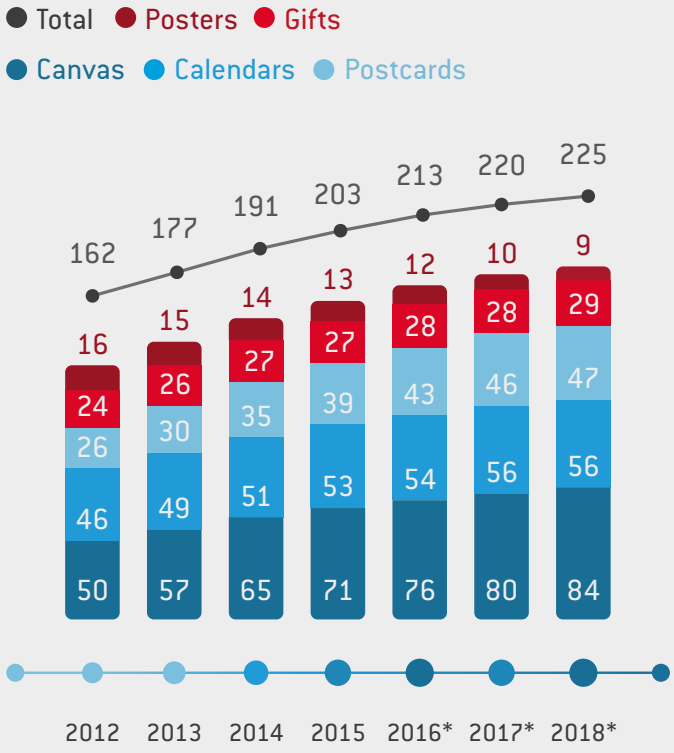
The latest studies of image service providers show that more and more smartphone pictures are being printed out on paper and other printable media. Consequently, the share of prints of pictures taken on mobile devices is continually rising and is currently between 20 and 25 per cent. The trade infrastructures that have been created, combined with smart paths, contribute to this ongoing positive growth. Consumers here in Germany, meanwhile, now have the possibility nationwide of connecting their mobile device via wireless local networks or via the mobile network with photo stations.

The "private photo lab", too, is increasingly designed for flexible uses. Smartphone photo printers – currently, a rise in models can be discerned – can be controlled via Wi-Fi just like photo printers or multifunction devices. Printing from the cloud is also supported with increasing frequency.

High-quality photo printers for prints with up to ten colors on A3 continue to be an interesting niche for discerning photographers; nonetheless, they are of high relevance to the market also in terms of the materials used. With increasing activities, for example, in inkjet-textile printing, the imaging

PHOTO MERCHANDISE SALES IN GERMANY

Value in million €

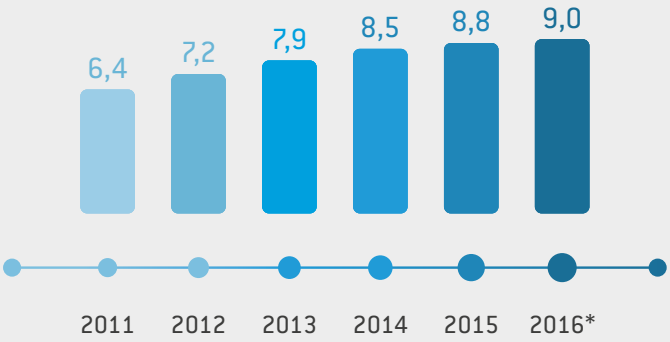


Source: FutureSource

*Estimate as of 08.2016

PHOTO BOOK SALES, GERMANY

Million units



Source: FutureSource/BGL

*Estimate as of 08.2016

industry is moving into new business segments, especially in the field of professional printing.

APPLICATIONS

Mobility and real-time communication are the drivers of innovation in the B2C market. Whereas "instant" photo printing up to now always required one to be physically present at the photo station in the store, web-to-print solutions and location-based services are becoming more important. In these processes, the file is transferred from the smartphone via a 4G connection to the photo service provider and can then immediately be sent to the nearest photo shop or drugstore, determined by GPS, where the prints can be picked up.

Sharing experiences immediately is an increasingly strong need. It is mirrored in the rising demand for photo prints in the classical instant photo format as well as in the growing live-streaming of videos in the social web. The latter has a strong potential for generating income for imaging service providers. QR-code access to video albums saved on the Web is now offered here and there, and could experience a big boost from the trend toward video-streaming.

New technologies like augmented reality, as well, will boost the photo print market if additional AR apps make it possible for consumers to determine the appropriate poster size by virtually overlaying motifs for them on their walls at home.

Among the new, rising trends in the merchandise sector are, for example, prints on rustic wood or photo hangings for outdoor use on weather-resistant metal mounts. New-fangled, scratch-free high-tech surface coverings with high color intensity and spatial depth effect, moreover, are spurring sales of personalisable photo wallprints.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

The printing branch has long since recognised digital innovations and smart applications as an opportunity and thrust them into future-orientated business segments. Established companies and start-ups are already driving the next evolutionary step of integrated print solutions for brick-and-mortar stores and e-commerce. In the future, photo merchandise might not be based solely on two-dimensional materials but emerge as 3D objects from the instant printer. In this, the development of platforms for solutions in the web-to-print, analytics and cloud storage sectors in this illustrates how the physical and digital worlds are merging.

FORECAST

Customers' desire to experience their pictures with print-outs on paper and other materials ensures that the imaging industry will have growing sales in the B2C market. Entering into 3D printing as well as cloud and video services promise to kindle new dynamics for growth.

WE ARE IMAGING

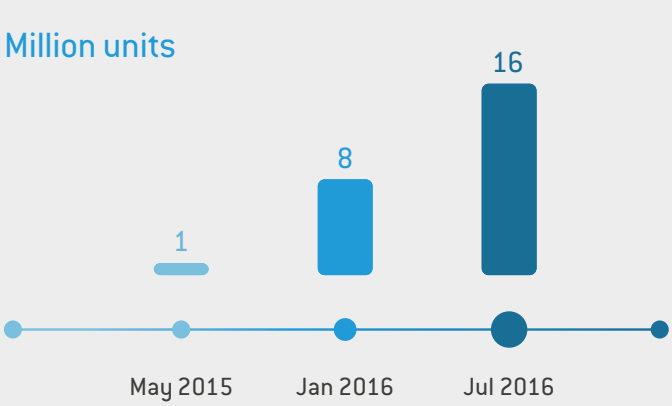
IMAGING TRENDS FOR BUSINESS CUSTOMERS

Imaging not only enriches the lives of photographers and videographers in the consumer and professional realms. The economy, industry, the healthcare sector and science all profit from technologies, products and services related to visualisation. Virtual reality and augmented reality make new perspectives possible for product development, training, marketing and logistics. Multicopters simplify professional aerial shots and might soon become a standard for inspections in industry. High-resolution video systems provide ever sharper images for security technology and increasingly simplify their analysis with intelligent software. Without modern imaging processes in the field of video, ultrasound and x-rays, modern diagnoses and operating procedures would not be possible. 4K video combined with integrated IT solutions make it easier for doctors to conduct their precision work. Self-driving cars and automated quality work in factories require precise measuring techniques – the imaging industry delivers them. In this sense, imaging companies play an important role in the digital transformation.

Virtual Reality for Use in Business Is Happening

Virtual reality (VR) is more than gaming, 360-degree photos or Hollywood in 3D. Data glasses with which users can interact in computer-generated surroundings make new viewpoints possible for business applications, too. These viewpoints revolutionise viewing experiences but also change the manner in which motifs and objects are placed in their settings for capturing. VR headsets visualise products and contents in novel ways, thus harnessing new potential in research and development, training, marketing, as well as sales. VR technologies are about to take off and generate considerable potential for added value for the imaging industry.

GLOBAL SALES OF "CARDBOARD STYLE" VR HEADSETS



THE MARKET

After the hype in 2014 and 2015, the shooting stars of this new imaging technology are now delivering. High-performance headset models with PC compatability that were announced with great fanfare are already available or are about to go on the market. For the current photokina year, IDC predicts (April 2016) about 9 million VR glasses will be sold worldwide. By 2020, the yearly sales volume could multiply to 64.8 million units. This figure does not include the entry-level and mid-range glasses, which make a functional VR headset with built-in magnifying lenses out of many currently sold smartphones. According to a market analysis (July 2016) of the VR glasses assembler Mr. Cardboard, there are currently 16 million models of the reference design "Google Cardboard" in use worldwide.

The demand from the B2B segment is playing a large part in this. Many of the simple cardboard models find their way to the market as advertising giveaways. Mid-range and high-end devices are being used in companies' pilot projects. In the coming years, they might increasingly be found as part of standard operations in many places. According to Deloitte (May 2016), German companies will invest about 840 million euros in solutions having to do with data glasses by 2020, although this study does not distinguish between virtual and augmented reality.

According to market researchers, glasses tied to PCs will play a greater role in the segment's growth. Mobile VR glasses tend to be targeted to consumers and lose their importance in their least expensive form as an advertising gift once the their novelty wears off. The device segment will allegedly only contribute a small part of the sales turnover overall since the VR headsets designed for universal use

> "By 2020 German companies will invest approximately 840 million Euros in solutions based on smartglasses."

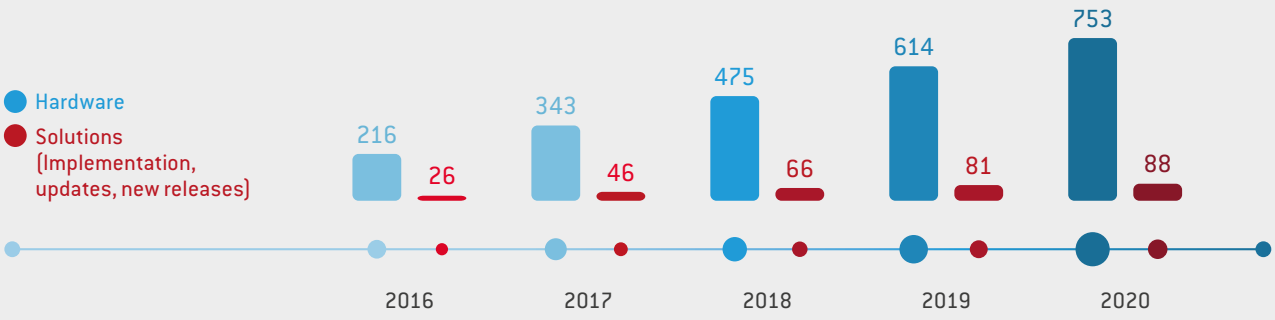
without having to fit with any hardware can also be used in the B2B segment. Customised software solutions for individual companies' needs will probably comprise 90 per cent of the business customer market for virtual reality.

APPLICATION AREAS

In research and development, companies can take a look at prototypes without actually having to produce them physically. For presenting products before they hit the market, virtual reality makes more of an impact than overhead transparencies. In virtual showrooms, retailers enable customers to configure the interior of their new car in an especially realistic way. Potential event locations can be compared at a distance in one stroke. Builders can walk through the planned factory building already in the design phase. To take part in driving simulations and training courses, participants do not need to

SALES ESTIMATE VR, AR AND MIXED REALITY IN GERMANY

Value in million €



 Source: Deloitte; Fraunhofer FIT; Bitkom © Statista 2016 as of 08.2016

leave their workplace. Technicians can carry out the assembly and maintenance of sensitive machines or at dangerous locations from a secure distance. Conversational partners save time and money by having virtual conferences.

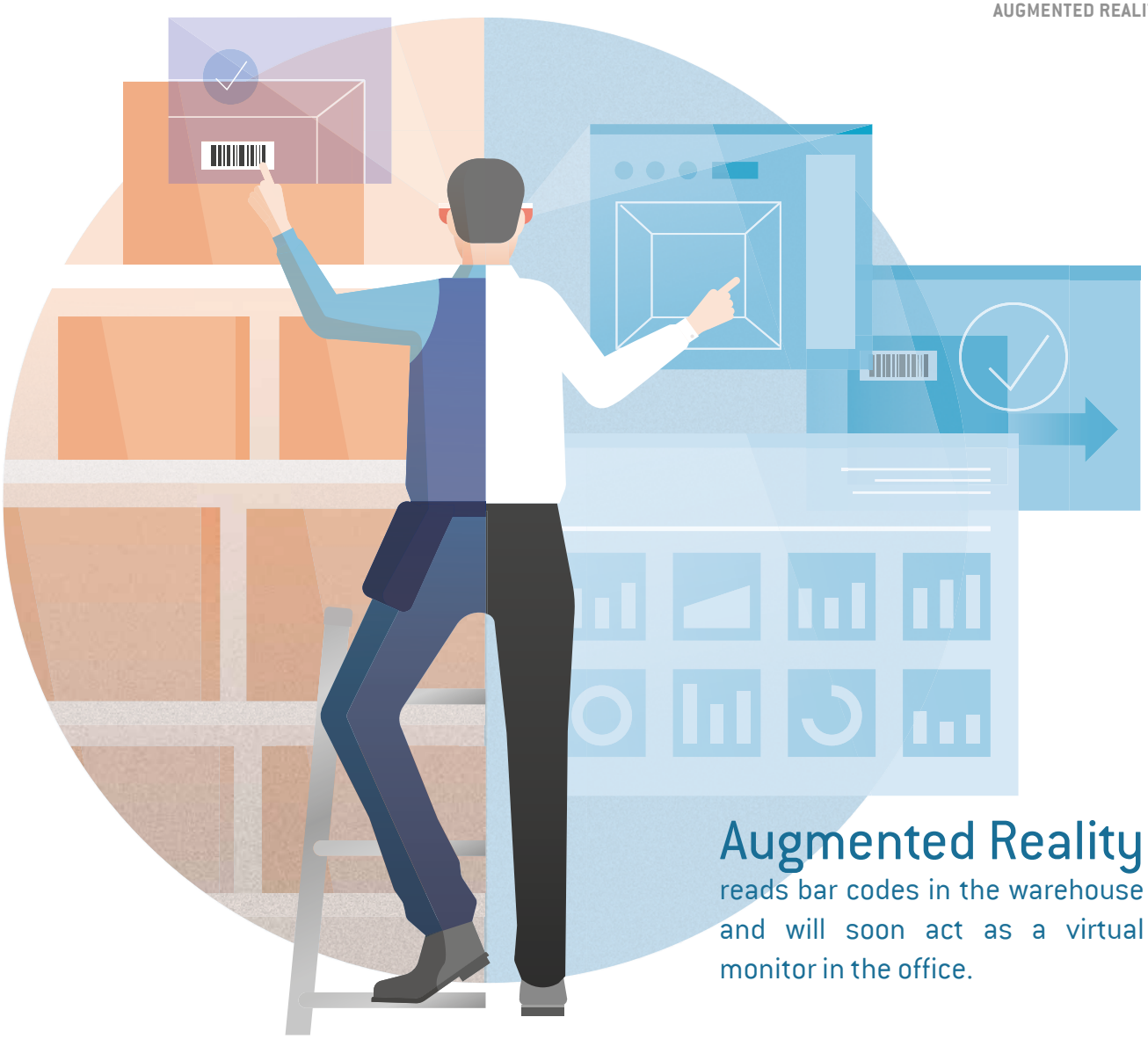
For the selection of applications mentioned here, high-performance VR headsets for PCs are primarily what is needed – ones that make very realistic representations possible. Higher-quality mobile headsets are ideal if more freedom of movement without a cable connection is required. Inexpensive entry-level headsets made of cardboard, in turn, are made for marketing. A 360-degree experience is a fascinating way to prompt interest in one's product array. In this way, companies can make use of the current attention virtual reality is receiving at events, in showrooms or retail display areas.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

Virtual reality is one of the largest growth areas of the imaging industry. From a technological standpoint, it touches on the industry's core expertise. Whether VR glasses make use of integrated displays or magnifying lenses, in every case a high-quality viewing experience requires sound optical know-how. Many imaging companies are expanding their activities and developing competencies in sensor technology and software development in order to offer single-source solutions.

FORECAST

Virtual Reality is happening in the B2B segment. After successful pilot projects and occasional use as a marketing instrument, VR solutions might soon be a central component in various functional areas of many companies. With hardware getting better and better, smart software solutions and new applications, imaging companies are actively advancing this development.



Augmented Reality
reads bar codes in the warehouse and will soon act as a virtual monitor in the office.

Augmented Reality

Work Glasses instead of a Work Computer

After setbacks in product development, things temporarily got somewhat quieter around augmented reality (AR). With the big-bang like success of the video game Pokémon Go, this imaging technology has jumped back into the public eye. This is advantageous for companies. Experiences with augmented reality in private life prepare employees for new processes to be introduced in the workplace as well. AR solutions will completely change the activities of warehouse workers, service technicians, medical professionals, etc., with more efficient work procedures. Imaging companies, with high-performance data glasses and applications, are the pioneers in this innovative market.

THE MARKET

In the professional world, augmented reality is gaining importance not through smartphone apps but through the use of smartglasses. So far, companies have used headsets that superimpose digital information on transparent screens in small numbers, mostly in pilot projects. Since the weaknesses of the first generations of models have increasingly been eliminated and more and more suppliers have prototypes ready to enter the market, analysts are predicting a broad-scale breakthrough. It is estimated that about 400,000 AR headsets will be sold worldwide in 2016, but in four years it is expected to be 45.6 million devices (IDC, April 2016). Digi-Capital (January 2016) predicts worldwide augmented reality sales for 2020 of 90 billion US dollars. In Germany, according to Deloitte (May 2016), companies will invest an estimated 840 million euros by the end of the decade in all things related to data glasses (including VR) – four times more than in 2016.

AR glasses, which present text, numbers and icons in the customary, two-dimensional way, are currently shaping the product range. We can expect next-generation models to arrive at the earliest in 2017, and more likely 2018: They will project 3D objects, making much more natural interaction possible. Hardware, however, might play only a small role in the total volume of the B2B market. According to Deloitte, 90 per cent of revenues in this segment pertain to development, licensing and maintenance of software solutions tailored to the needs of individual companies.

> "In 2016 an estimated 400,000 AR headsets will be shipped. By 2020 this figure is likely to increase to 45.6 million."

POSSIBLE APPLICATIONS

Deloitte's market researchers have already registered meaningful sales in the fields of logistics, remote servicing and production. Over the longer term, among other things, applications for video conferencing and teamwork will be added.

When users view written instructions on a pair of AR glasses, their hands are free for other things; they are more flexible and complete the task more efficiently. Factory workers can superimpose assembly instructions; service technicians can receive details for a particular job. By means of the integrated camera, additional experts can examine the situation, as it were, through the eyes of the observer and provide support from a distance. The cameras help logistics personnel to automatically discern bar codes and thus identify a desired article more reliably. Driving directions projected onto one's glasses replace the need to look away from the road at a map or smartphone.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

Augmented reality is a market with immense potential, with imaging companies actively setting the pace. High-resolution displays with high contrast that can also be read in bright sunlight are crucial for the quality of the presentation. Moreover, digital information ought to complement one's field of vision without blocking one's view. Imaging companies have made great progress in relation to these issues and are now, in some cases, already offering third-generation devices. In addition, the interplay of device manufacturers and innovative software start-ups is contributing to generating tailor-made solutions that fit particular companies to a tee.

FORECAST

Among the numerous, promising imaging trends, augmented reality is one that will revolutionise and shape industrial production, as well as medical and technical-scientific fields, for decades to come. The use of augmented reality represents an unimaginable

enrichment with limitless added value. Among other things, imaging technology improves production processes, reduces error rates, increases speed, and generates competitive advantages. B2B solutions will drive the total market in the coming years. Yet influences from the consumer segment cannot be excluded: For example, consumers may drive the development of headset models that come closer to the charming design of traditional corrective lenses.

TWO MARKET STRATEGIES FOR AUGMENTED REALITY GLASSES

The market for augmented reality headsets is in an early phase, with product concepts still being established. Basically, two approaches can be discerned up to this point. At the moment, AR users utilise headsets with small, half-transparent screens installed into the ocular surface. The displays expand one's visual field with two-dimensional text and picture information appropriate to the surroundings. These AR headsets are connected to a smartphone, control box or PC either wirelessly or with a cable.

The next-generation models currently in development, which are not yet ready for production, take a different approach. They project 3D objects onto a transparent ocular surface, thus overlaying one's actual surroundings. Consequently, this technology is also sometimes referred to as mixed reality. Depending on the model, this generation of headsets no longer requires a separate computer.

Pictures: Epson, Microsoft

Multicopters

A Vertical Launch for the Aerial Photo Market

Multicopters not only simplify photo and video capturing from the sky, because now there are also a lot of models that dive underwater. Whether above or below water, this genre is clearing the path into new visual spheres. The market is growing as fast as a rotorblade turning at high speed. The sustained trend of multicopters is prompting innovative ideas in relation to high-quality capturing technologies and virtual reality displays. This is currently generating momentum, above all, in the B2B multicopter segment.

THE MARKET

Unmanned aerial vehicles (UAV) developed from a military instrument into an important civil market. The number of types manufactured for civil or commercial purposes more than tripled between 2010 and 2016 from 171 to 561 models, according to the manufacturing association UVS International. Already today, rotor-propelled drones, so-called multicopters, are being used especially for aerial photography across a broad spectrum of applications. The federal association of copter pilots (BVCP) claims that there are 400,000 UAVs in use in Germany, many of them by end consumers. Just for Christmas 2015, according to the BVCP, 100,000 multicopters were given as presents in Germany.

Despite the existing hype, this product category is only at the beginning of its life cycle and has tremendous growth potential. According to the research institute MarketsAndMarkets, the worldwide sale of multicopters will multiply by the end of the decade to 5.6 billion US dollars, with an annual growth rate of 35 per cent between 2015 and 2020.

Currently, the market is driven by supply. More and more manufacturers are making ready-to-use complete solutions including a camera and accessories. The range extends from products for enthusiasts that cost a few hundred euros to high-performance professional varieties for four and five-figure budgets. The infrastructure for sales, training and operation is still in development and presents interesting new business opportunities that will further expand the imaging ecosystem in the future.

Open questions on regulating air traffic will increasingly be taken up so that this large obstacle to growth will lose significance. As a result, flying multicopters will basically become an ever more attractive experience for consumers as well. However, in light of the various commercial application areas, the B2B segment holds the greatest potential for the imaging industry.

APPLICATION AREAS

Compact and remote-controlled multicopters not only make it possible to take aerial shots and videos in a practical way. Their deployment is much more flexible than that of camera cranes or manned helicopters. In the leisure segment, multicopters are currently especially in use among model airplane enthusiasts. More and more ambitious hobby photographers and videographers are discovering the genre for themselves. The market also gets a boost from events such as competitions. Used commercially, multicopters deliver pictures for security agencies and guards, photojournalists and entertainment film crews, as well as for farmers, surveyors and construction site inspectors. Multicopters are also

By now there are 561 different types of multicopters, for both personal and commercial use.

being deployed underwater more frequently when the condition of the underwater world needs to be checked.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

As multicopters become more widespread, the demand for high-quality capturing equipment is rising especially among discerning business customers. The imaging industry, with its know-how, makes it possible to produce sharper and more colour-accurate pictures despite flight vibration and haze. For this, copter manufacturers, noticeably, are cooperating with well-established specialists in creating capturing devices in order to make the best possible product available for customers. A current trend in multicopter photography is a zoom lens that can be operated by remote control, because at the moment most models are equipped with wide-angle lenses of fixed focal length. In addition, the next generation of multicopter models will be controlled by virtual reality glasses. The imaging industry is contributing to this, among other things, with its display expertise to enable a precise control experience.

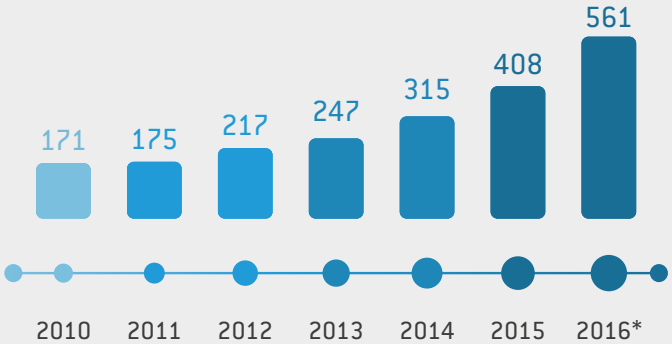
FORECAST

Multicopters are a growth market that is fed by the model airplane and electronics world, yet it has considerable spillover effects on bordering economic branches. Although camera and lens manufacturers are participating in the current upturn, accessories and image output – especially with regard to 4K screens and VR headsets – can be expected to lift off in the next step. In this respect, the mega-trend of multicopters is giving rise to an imaging ecosystem of its own.

KNOWN ACTIVE MULTICOPTERS FOR CIVIL OR COMMERCIAL USE

PIV WE ARE IMAGING

Number of models



 *Estimate
Source: UVS International, RPAS Yearbook 2016/2017, June 2016

Security Systems

A Long-Term Growth Market

The need for more security, as well as new application scenarios in home automation and e-commerce, are spurring the market for video systems. With high-resolution image standards like 4K as well as ever more efficient processes for analysing pictures, the imaging industry is combining know-how from capturing technology and IT in a smart way – and consequently is setting new quality standards for security and comfort in everyday life.

THE MARKET

The market for security systems has been experiencing an upswing for years. For recognising security risks in real time, video cameras are the choice instrument. This year, according to a prediction by the research institute MarketsAndMarkets, revenues will reach 25 billion US dollars worldwide. About 19 billion US dollars of this can be attributed to cameras with an Internet connection. China is playing a big role in driving demand; market researchers at IHS claim that China accounts for 46 per cent of the global revenues of security cameras in the year 2016. In Germany, according to BHE and ZVEI, the revenues in the year 2015 amounted to about 473 million euros. By the year 2022 global revenues will rise to over 71 billion US dollars, MarketsAndMarkets estimates.

One growth driver is the shift to higher-resolution image standards. IHS claims that sales of HD or Full-HD cameras in 2016 will reach about 28 million, surpassing SD camera sales for the first time. Although the next generation is already standing ready with the modern 4K standard, equipment is replaced at longer intervals in the professional environment than in the consumer segment. Thus, the breakthrough of 4K in video surveillance has probably been a topic for a long time.

The new market segment of bodycams holds further potential. IHS estimates worldwide sales of shoulder cameras for police departments in 2015 at 135,000 units. This number could rise rapidly if not only security agencies but also private protection services utilise bodycams in the future. Over the longer term, multicopters equipped with security cameras could drive the market to new heights.

More cameras with higher resolution increase the demand for computing and storage capacity at the same time, which generates potential for offers from one source. On account of their scalability, cloud solutions are becoming more important. Stationary servers are fading into the background, particularly since a noticeably greater portion of image analysis now takes place within the camera unit.

APPLICATION AREAS

Monitoring buildings and properties with camera systems is a widespread practice. Instead of merely serving security, in the age of the Internet of Things they could, in the future, also contribute to the automisation of buildings. This is due to computer-supported image analysis that is growing ever more sophisticated. If the video system recognises how many people are occupying an area, for example, at events, the remaining space capacity can be determined. Automatically adjust the heating and light to the preferences of those present? No problem!

Along the lines of Smart Home applications, Smart City comprises a promising application area for network cameras. In addition, IP-based cameras make new forms of customer analysis possible for

brick-and-mortar stores, which can utilise them to make their sales floors interactive.

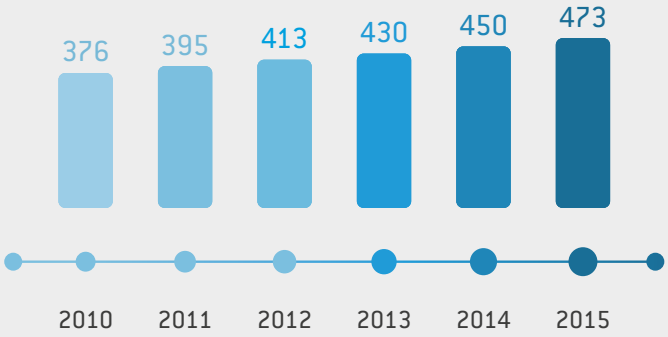
THE CONTRIBUTION OF THE IMAGING INDUSTRY

The imaging industry, a driver of innovation in this segment, is also firmly anchored in it with its portfolio of integrated security solutions for indoor and outdoor areas and its know-how. Cameras are a current focus; for example, with infrared capability, large-format CMOS sensors or 4K video quality, they guarantee richly detailed images despite poor lighting conditions, and they just keep getting better. Fast, high-performance lenses, meanwhile, cover ultrawide angles with minimal distortion, which reduces the number of camera units necessary, as well as project costs.

High-performance compression processes make it possible to monitor and record several streams at the same time. Along with image analysis software that is optimised for the cameras, network recorders, monitors and system controllers are often offered as a complete package.

VIDEO SURVEILLANCE TECHNOLOGY SALES IN GERMANY

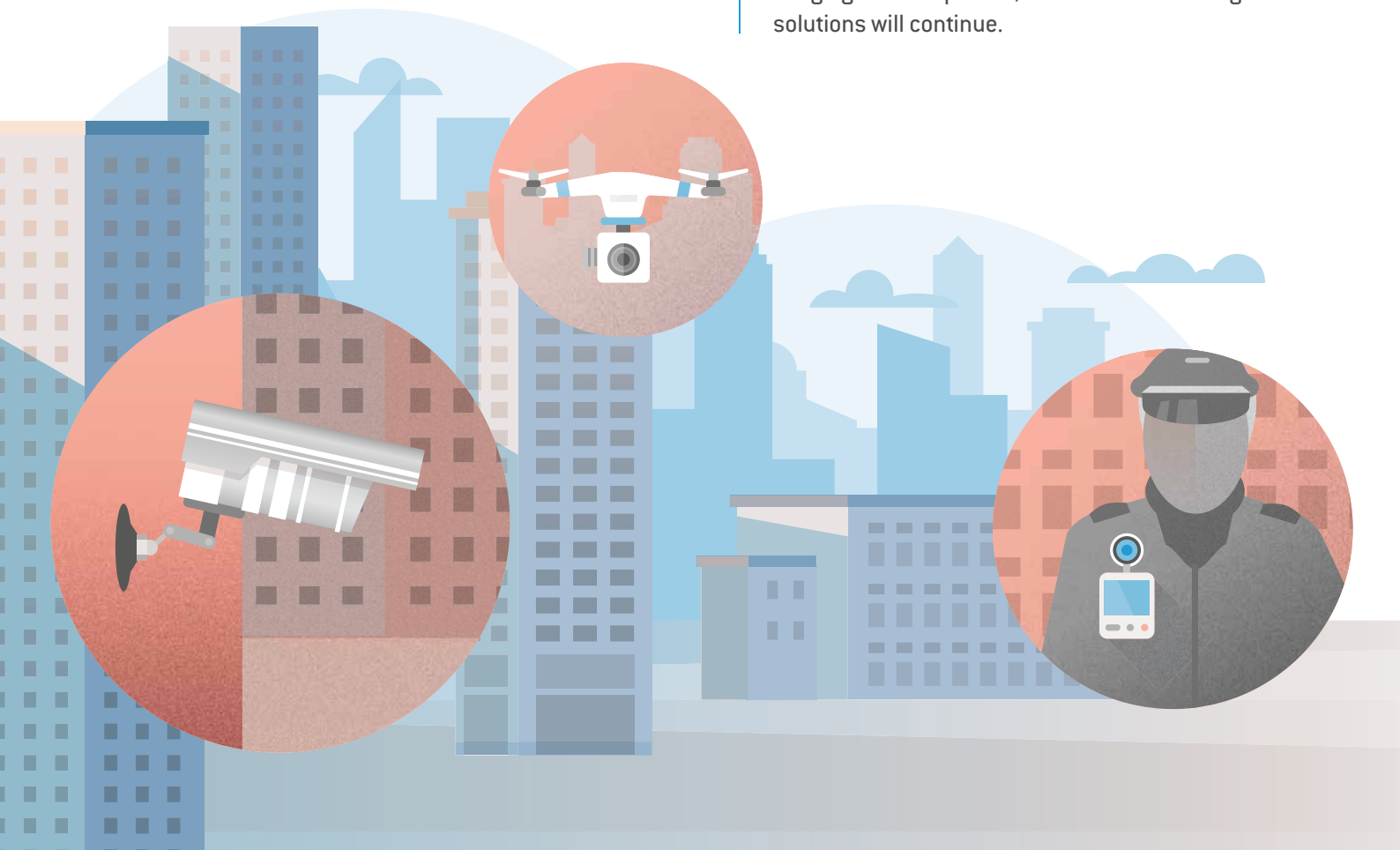
Value in million €



Source: BHE / ZVEI, June 2016

FORECAST

Security systems will remain a growth market for years in both the B2B and B2C segments. Within the imaging ecosystem, security products relating to cameras, software, accessories and storage constitute a tightly interlinked area that is constantly expanding to include new devices and applications. Because modern video systems require both imaging and IT expertise, the trend toward integrated solutions will continue.



Medical Technology and Research

In Good Hands Thanks to Good Eyes

Thanks to the know-how of the imaging industry, patients are in good hands when they are with medical personnel. Whether video, ultrasound or x-ray – without the imaging solutions of the industry, modern diagnosis and treatment would be unimaginable in many specialist disciplines. Current innovations like 3D endoscopes, 4K special displays as well as headsets for augmented and virtual reality give doctors new points of view. For this, system solutions including imaging software and data security are needed because medical technology and IT are merging more and more.

THE MARKET

Medical technology is a growing future market that keeps expanding and will continue to do so for some time. According to the study by EvaluateMedTech (October 2015), revenues in the current calendar year are anticipated to reach 388 billion US dollars worldwide and rise by 2020 to 478 billion US dollars. This covers a broad and diverse spectrum of medical technology.

One gets a better idea of the core activities of the imaging industry by looking at the imaging endoscopy market. Wand, tube and capsule endoscopes with a videocamera or ultrasound probe mounted on the end are the key products. A complete imaging ecosystem has developed all around these products, including hardware and software for taking, analysing, presenting and saving images.

The growth curve of this market segment is definitely pointing upward. Analysts from MarketsAndMarkets predict a worldwide increase in revenues of 41 per cent to 33.6 billion US dollars by the end of the decade. In 2015, revenues added up to 23.8 billion US dollars.

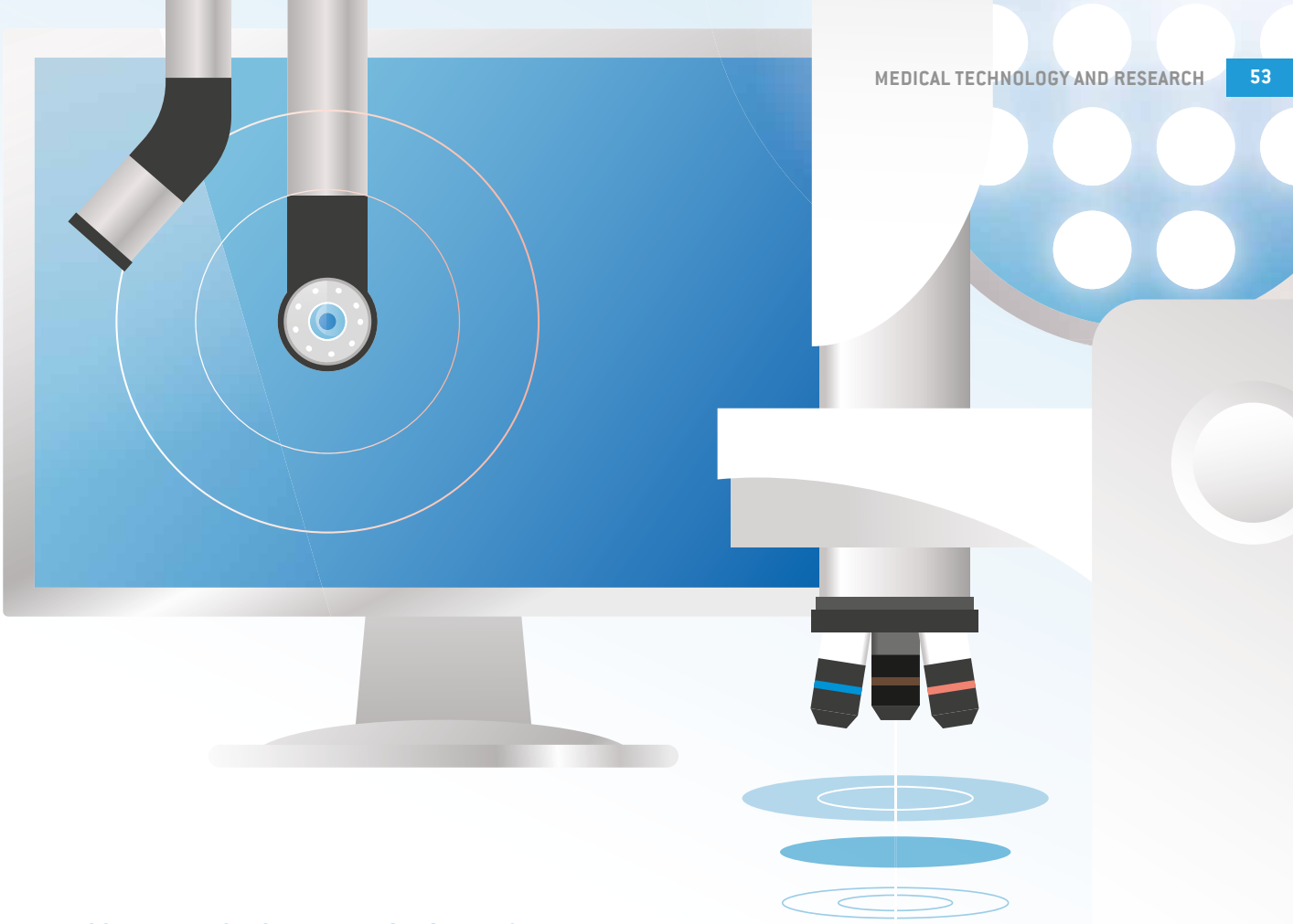
Microscopy is another important business segment. Among the signficant trends spurring growth are very high resolution and digitalisation of images. MarketsAndMarkets estimates that worldwide revenues (4.7 billion US dollars in 2016) will rise to 6.7 billion US dollars in 2021.

In addition, the imaging industry is active in other medical technology segments – from solutions for opthalmology and instruments for ENT operations to in-vitro diagnostics and x-ray machines.

APPLICATION AREAS

Concerning the focus of endoscopy, relevant solutions are needed wherever cameras or sonar devices are supposed to provide information from inside the body. Surgeons are now relying more and more often on minimally invasive procedures that involve very small cuts where remote-controlled instruments are then inserted. Without endoscopes with high-performance lenses and image sensors, the navigation of these instruments would not be possible. For diagnoses in many medical specialty areas, video or ultrasound endoscopes are just as indispensable.

Users of modern microscopes – basically full-fledged computers nowadays – aim to get to the bottom of even the smallest matter in teaching, research and practice. Integrated hard drives and special software as well as connected monitors make cutting-edge interpretation possible.



THE CONTRIBUTION OF THE IMAGING INDUSTRY

Three-dimensional and ultra-high-resolution visualisation is a current focus of the imaging industry with which it makes precision work in medicine easier. 3D endoscopes equipped with dual cameras make stereoscopic – that is, much more realistic – representation possible. In addition, virtual reality headsets are being utilised to provide operators with a more vivid overview for difficult procedures. Augmented reality headsets can help, say, dentists by overlaying additional information on the ocular surface.

The trend is toward system solutions. Along with just taking pictures and analysing them, imaging companies offer coordinated peripheral devices like monitors, printers, printing media and recorders that make image evaluation, output and documentation easier. For presentations rich in detail and with high colour brilliance, the 4K video standard is increasingly moving into the field.

Networking is also enjoying growing significance. For example, operations can now be broadcast via Live Streams. This allows operators to consult in real time with specialist colleagues even during the procedure. In addition, medical students can participate in them and learn from them without actually standing directly in the operating theatre.

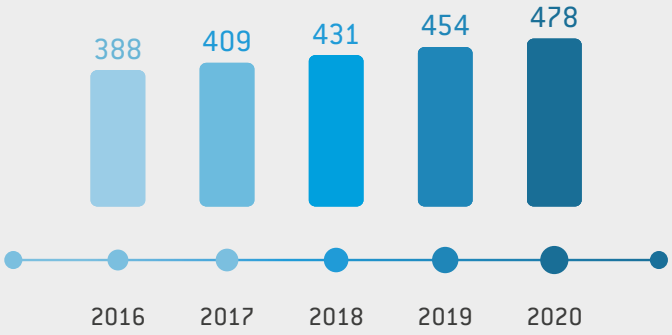
FORECAST

Beyond innovative medical technology hardware, digitalisation will influence the market more powerfully than before. Along with self-learning software for automated image analysis, this will also affect the compilation and evaluation of patient information via big data solutions.

ESTIMATED GLOBAL MEDICAL TECHNOLOGY SALES

PIV WE ARE IMAGING

Value in billion US $



Source: EvaluateMedTech, October 2015

Automotive and Industrial

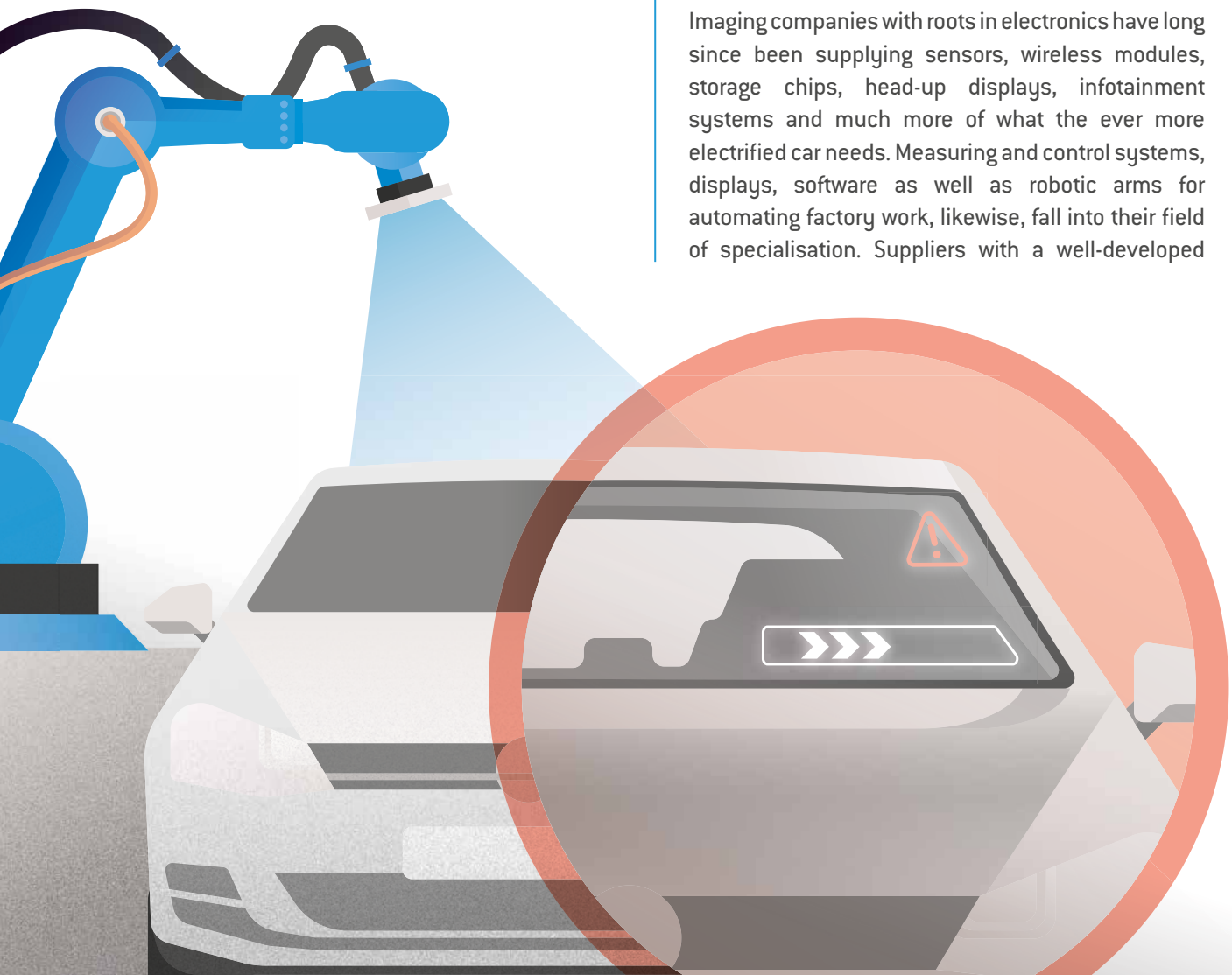
I See Something You Don't See

If cars should drive without drivers and factories run without machine operators, then the need for measuring and control technology will rise dramatically in the future. Even today, imaging companies are advancing traffic and automotive engineering with innovative cameras, sensors, testing instruments and robotic arms. Increasing connectivity in the Connected Car, in the Smart City and in Industry 4.0 hold incredible growth potential. The imaging industry is well equipped to accompany people and companies as they traverse the digital transformation.

THE MARKET

Known for consumer cameras and printers, many imaging companies have been offering solutions in the automotive sector for years. As a supplier in the expansive B2B segment, the industry is quite diversified.

Imaging companies with roots in electronics have long since been supplying sensors, wireless modules, storage chips, head-up displays, infotainment systems and much more of what the ever more electrified car needs. Measuring and control systems, displays, software as well as robotic arms for automating factory work, likewise, fall into their field of specialisation. Suppliers with a well-developed



optical tradition have specialised in testing and diagnostic instruments and systems. Integrated software solutions as well as services like training, maintenance and support round out the industry's portfolio and generate tremendous added value.

In these ways, the imaging industry is participating in many industrial growth markets. One of these is the market for the Connected Car with its constant Internet connectivity, its intelligent security and assistance systems, as well as sensors that anticipate needed maintenance – a preliminary step toward the autonomous car. According to Statista, the market for Connected Cars will reach 27.6 billion euros worldwide in the current year. By the end of the decade, it is anticipated to more than triple to 89.4 billion euros. The largest subsegment alone – for security and assistance systems – represents 17.4 billion euros in revenues in 2016.

The market for automating car manufacturing, likewise, is constantly getting bigger and will grow about 6.7 per cent per year to 202.4 billion US dollars by 2020, according to the research institute MarketsAndMarkets. Among other things, this figure includes industrial robots and imaging systems that enable machines to see. The world market for nondestructive testing (NDT) – a strong field for imaging companies – is significantly smaller but is growing more rapidly. MarketsAndMarkets claims it will nearly double from 4.77 billion US dollars in 2015 to 8.55 billion US dollars in 2022.

APPLICATION AREAS

High-quality new cars no longer leave the factory nowadays without an all-around camera system. Semi-transparent computer displays are now also installed in the windshield more and more often. Parking assistance with a rear-view camera, distance sensors and other driver assistance systems, too, require the comprehensive use of connected technology. The imaging companies combined in the Photoindustrie-Verband (PIV, Association of the Photo Industry) not only supply parts and components for making cars themselves but also production, inspection and quality-assurance solutions that are implemented on the assembly line, in the testing lab or in the repair shop. Portable testing devices and stationary testing systems, using ultrasound probes or x-rays, find cracks, hollow areas and porous material,

> "By 2020 connected car sales will increase to 89.4 billion Euros."

for example, in welding seams or turbines. Robotic arms assemble components to form a car or are utilised in automated quality inspection procedures, where, together with optical testing devices, they can recognise and remove defective parts. Industrial microscopes inspire production patterns with digital cameras and specialised software.

THE CONTRIBUTION OF THE IMAGING INDUSTRY

The more tasks digital assistance systems take over in cars, the more important it will become for them to supply precise and reliable information. With a wide selection of sensors, semiconductors, displays and integrated capturing systems, the imaging industry is making its contribution to the automobile traffic of the future as a supplier to the automotive industry. After all, even before a car hits the pavement for the first time, the industry profits from the know-how of the imaging industry. Without the sometimes automated quality inspection procedures that use laser scanners or other measuring technologies from imaging companies, it would hardly be possible to maintain such a high standard for many products. In this sense, the imaging industry is making life smarter and more secure in many areas.

FORECAST

The autonomous car has not yet become a reality, and Industry 4.0 is only slowly beginning to take shape. Yet even in their present form, digital and smart solutions for automobile traffic and manufacturing are already in high demand. The increasing connectivity of cars and factories, and the rising demand for security systems and quality assurance that goes along with it, should be regarded as a long-term trend. It will enable the imaging industry to generate growth potential for years to come.

Imaging Unlimited

The Way of the Future

The innovators of the imaging industry bear a large part of the responsibility for the far-reaching change that revolutionising digital technology has triggered in all areas of life. They made it possible for everyone today to be able to take perfect photos and videos at any time very easily and then share them worldwide with anyone. In Germany, by now 76 per cent of the population (Source: Bitkom) possesses a smartphone and thus a camera. A connected camera not only records what we see but also takes a note of where, when and how the photos were taken.

Via apps, they can even provide useful information about the motifs and tell which other interesting photo motifs are nearby; they can provide information about a café where one can relax after a photoshoot or what time the sun will be at an optimal position for a successful photo. These do-it-all devices, moreover, have developed into multi-faceted accessories for other, high-quality capturing devices. At a time when the "Internet of Things" is propelling the connectivity of nearly all technological devices at a rapid pace, cameras form the basis of seamless integration for all of the devices that work together in the "Imaging Chain".

"ICONIC TURN" – FORMS OF IMAGE COMMUNICATION SHAPE THE VIEW OF THE WORLD

Digital photography presents the largest transformation in communication since Gutenberg's

> "We will never drown in a flood of images. This is an unsubstantiated fear. We need visual communication just like we need air to breathe."

printing press revolutionised written communication. Dr. Hubert Burda, an art historian and former publisher in the media industry who has been dealing with the "Iconic Turn", the revolution of image communication, for decades, emphasises in his book "In medias res – The Iconic Turn": "Wherever communication changes, the foundations of society change." The "Iconic Turn" or "Pictorial Turn" – this is how Burda refers to the shift from text to image communication – has global effects, he says, on the way people in the digital age communicate with one another. For example, we often become aware of events first via digital platforms like Facebook, Flickr and such, where every individual can become the director of his own production, rather than via media presentations. With the possibility of easily making a picture of the world for oneself, this new form of communication with images, in turn, will shape our view of the world.

THE PICTURE – NEVER HAS IT BEEN MORE VALUABLE THAN TODAY

The omnipresence of pictures, among other things, prompts the fear that we could drown in a flood of them. Yet the worry that we will no longer see the world for all the pictures in it is proving not to be well founded. On the contrary! Pictures are an indispensable part of communication, of information, as well as of entertainment. They are as much a part of life as breathing.

Why do pictures have this prominent importance? Why can we not get enough of pictures? Why do we consume more and more pictures every day? What do images do so that no one can do without them? Wherein does their magic power lie? Rüdiger Schrader is a photographer who was once the youngest chief reporter of dpa, then the youngest chief picture editor at Stern, and for many years the head of picture editing for Focus. He knows why certain pictures cast a spell on people. Now a coach of professional photographers and a photography master class teacher, he is convinced that visual thinking not only makes communication easier but also helps photographers take better pictures. "People take in pictures faster than language or text", he explains. "Whoever thinks in pictures and expresses himself in pictures will be able to convey his messages more easily and memorably".

A TRILLION PHOTOS PER YEAR

Members of the up-and-coming generation already learn to capture their lives in pictures and present them to the whole world during their childhood. ‚Selfies', the new form of self-presentation, have made their way even into museums, and have developed into both cult and also art objects. In the last year alone, more pictures were taken than in all the years before that taken together. It is estimated that there were about 1 trillion photos (Source: mylio). If we printed out all the pictures taken and saved within the last year and printed them out as 10 x 15 cm prints and set them side by side, they would stretch over a distance of 320 million kilometres. That is greater than the distance from the earth to the sun and back again.

CAMERAS ARE MAKING MACHINES SEE

Smart Imaging technologies have made it possible for machines and devices of everyday life to see, too. Cameras for industrial purposes even see better than human beings. They make invisible things visible. They produce pictures of distant galaxies or penetrate the microcosmic world, where they can capture nano-sized particles. If one made such a nano-particle equivalent to a ball with about a 30-centimetre diameter, then one metre would correspond to about the distance between the earth and the moon.

Be they surveillance cameras that can distinguish between friend and foe or optical testing systems

for quality assurance that never get tired, or cameras in refrigerators that tell us which foods are running out or cameras in a car, which are necessary for self-driving cars – all of these use imaging technologies for information and communication.

INTERACTIVE, VIRTUAL WORLDS

At the latest with the hype surrounding the computer game Pokémon Go!, virtual reality and augmented reality have now become the talk of the town. This new means of experiencing images interactively (VR) and enriching them with the help of artificial intelligence that adds picture information (AR) has now also been discovered by the media. For example, the Süddeutsche Zeitung presented 360-degree photo reporting from the Olympics in Rio de Janeiro. All of the larger picture agencies nowadays are using 360-degree VR cameras to deliver novel worlds of experience that visitors can navigate freely. The opening and closing ceremonies of the Olympic Games in 2016 could be experienced worldwide in VR images and 3D videos on TV and online, too. The picture agency Getty equipped every one of its photographers with a 360-degree camera for reporting from Rio as well.

PHOTO DRONES – REDISCOVERY OF AERIAL PHOTOGRAPHY

In the search for images that powerfully draw attention to themselves, aerial photography has gotten a boost – this time with unmanned flying devices. This category, originally inspired by model flight, is growing in leaps and bounds. Studies indicate that one in every twelve people is either planning on buying a photo drone in the next twelve months or is at least thinking of making a purchase (Source: TMS Emnid on behalf of Reichelt Elektronik). The superiority of relatively small drones is by no means exhausted by cost savings but also entails primarily their greater flexibility. By making it possible to get closer to the motifs, entirely new, impressive viewpoints can be obtained. Unmanned photo aircraft are not only an advance for creative photography. They have also taken over important tasks in surveillance in industry, for rescue operations, for fire departments and the police.

NOVEL WAYS OF EXHIBITING AND SEEING

The blending together of photos and videos as well as electronic reproduction of images on displays are leading to new ways of exhibiting and seeing them, such as cinemagraphs. These short animated loops comprised of several photos or time-lapse sequences are already considered their own category of photo art, which numerous photographers have already discovered for themselves.

RENAISSANCE – COMBATTING TRANSIENCE

The transformation in the imaging world has effected a fusion of digital and analogue technologies as well as a renaissance of pictures that can be held in one's hand. Instant photos are experiencing a new boom. Members of the generation that is used to browsing through pictures on the display are in the process of newly discovering their love for the picture they can hold. Fine art prints for the living room, photo wallprints for the bathroom, or even one's favorite motif as decoration for the garage door – all of these are among the new trends in the age of transient, rapid picture communication over social media platforms. In the same way, the photo album category is always developing further, inspiring manufacturers to constantly invent new variations; some also take up new visual trends like AR.

IMAGES – HOOKED ON NEEDING EVEN MORE

Taking pictures still counts among the most popular, creative activities. Whether as pure documentation, as a form of creative expression, as professionally or artistically generated photos or videos – images can be understood equally by all people. They clearly make people hooked on even more pictures. The more pictures the world reflects on us, the more we want to see and produce our own pictures. We simply cannot get enough of seeing pictures. The way we take pictures, exchange them and save them feels like it is changing by the second. Taking pictures is so easy today and as natural as eating and drinking. But no feeling of being full seems to be setting in, and our thirst for ever more visual experiences remains unquenched as before. What tremendous prospects for a unique industry!

Representing the Interests of the Photo and Imaging Industry

Photoindustrie-Verband e.V.

4i – iNSIGHTS, iNTERACTION, iNSPIRATION, iMPULSES – COMPETENCE TOGETHER WITH SUSTAINABILITY AND CONTINUITY

The Photoindustrie-Verband e.V. (PIV, The Association of the Photo Industry) represents the interests of the photo and imaging industry. It has been successfully dealing with matters relevant to the field also beyond Germany's borders for a decade. In order to bring its work as the leading interest group into the age of future imaging ecosystems, PIV issued a new brand image at the beginning of the year. Our central focus is the statement: WE ARE IMAGING, with which PIV positions itself as the driving force in the photo, imaging and visual communications market. The brand image is fleshed out with the 4i Strategy iNSIGHTS, iNTERACTION, iNSPIRATION and iMPULSES. The four terms stand for the most important forces and values that PIV will use to actively shape the industry in the future.

iNSIGHTS

stands for PIV's task of explaining the effects of digital progress, in general, and for the imaging industry, in particular. This includes determining and analysing trends as well as projecting them into future scenarios.

iNTERACTION

of the 4i Strategy is almost self-explanatory: PIV offers an open platform to all groupings and market participants in the imaging industry, fostering ongoing and cooperative exchange of information. An essential point of interaction is to connect the various players in the industry, to promote efficient cooperation and thereby to generate win-win situations.

iNSPIRATION

as the third pillar of the 4i Strategy means stimulating the innovative forces within imaging markets, passionately taking up even unusual ideas, and finally shaping the future of the imaging industry in creative ways.

iMPULSES

means that PIV acts as an incisive mouth piece for the imaging community. With dedication and service orientation –as before – it supports the interests of its members and proactively initiates pioneering changes in the fields of photography, imaging and visual communication.

PIV members include German and foreign manufacturers as well as service providers from the fields of digital-imaging, precision-engineering and optics, photochemistry, photoelectronics, video and presentation technologies, imaging software and accessories. The variety represented within the membership structure is reflected in the topics that the association pursues. PIV possesses a national and international industry network as well as specialist knowledge with the core competence „WE ARE IMAGING“. With around 50 members, the PIV (Association of the Photo Industry) represents more than 90 per cent of the sales volume of the photo and imaging industry. The association's activities are marketing and PR orientated, but it is also embedded in lobbying German and European legislators and agencies in close cooperation with industrial trade associations.

The Association of the Photo Industry (PIV) is a co-organiser of photokina in Cologne, the largest convention for photography and imaging in the world. As the leading convention of the industry in the world, photokina is an essential component of what happens in the market among the member companies. In its role as co-organiser, the Association of the Photo Industry actively participates in further developing the concept for the convention as well as the supporting program. Together with the KoelnmesseGmbH, it arranges press conferences in the most important sales markets worldwide, thus supporting the marketing of photokina, which takes place every two years in Cologne.

In the course of defining its new mission statement, PIV has presented itself since 2016 under one brand: The two individual brands Photoindustrie-Verband e.V. and Prophoto GmbH, which each had different target groups and brand environments, have now merged to form the new brand „PIV“. This one-brand strategy aims to generate a strong brand with high visibility that will stand for the topic of imaging for a long time to come.

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This publication presents non-binding general information. The contents reflect the opinion of the Photoindustrie-Verband (Association of the Photo Industry) at the time of publication. Although the information was compiled with the greatest possible care, the publishers make no claim to factual accuracy, completeness and/or currency; in particular, this publication cannot take into account the special circumstances of individual cases. Readers therefore use the information at their own risk. Any and all liability on the part of the publisher is excluded.

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