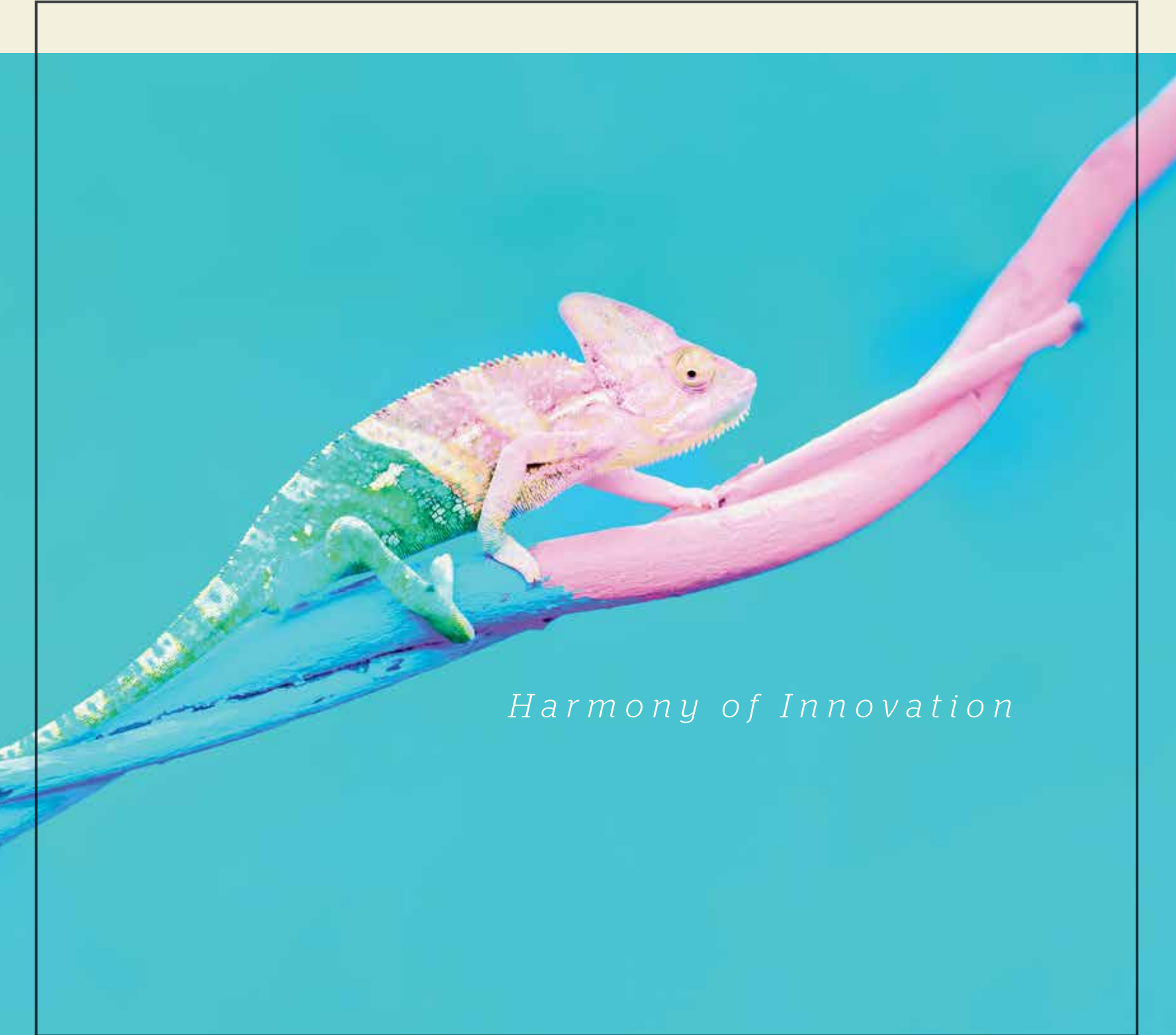


# THE REINFORCER

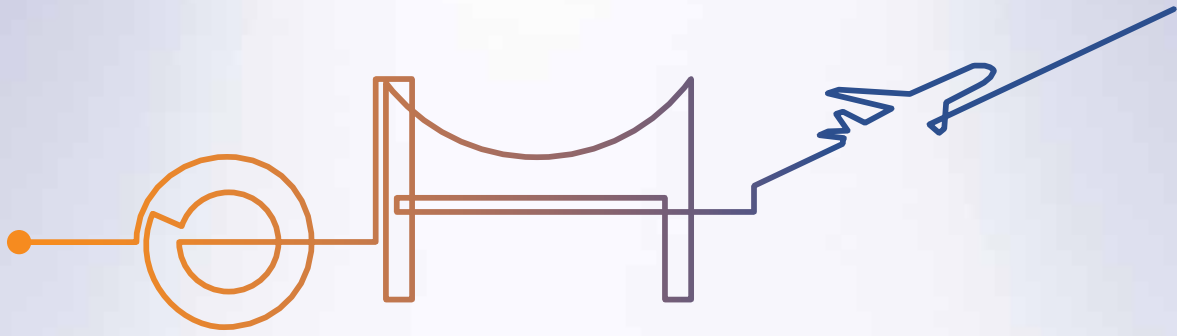
KORDSA | BULLETIN | N.09 | 2018 | TURKEY

*Determined to Create Value*

KORDSA



*Harmony of Innovation*



# KORDSA REINFORCES LIFE ALL OVER THE WORLD

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1 out of every 3 automobile tires and 2 out of every 3 aircraft tires manufactured worldwide are reinforced by Kordsa technologies. With its strategic investment, Kordsa now reinforces the hulls and wings of aircrafts with its composite technologies.

Acquiring two companies, which are strategic suppliers of commercial aviation industry, Kordsa continues to reinforce life by extending its technology leadership to the whole world.

N. 09 | 2018, The Reinforcer is a bi-annual publication by Kordsa  
thereinforcer@kordsa.com - www.kordsa.com

Published by  
Kordsa

Director  
Corporate Communication Office

Graphic Design  
Tazefikir Group

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We remain committed as ever to our philosophy “We Reinforce Life”. We will continue to invest for the future, and to create unique value through innovation, and we will redesign and reshape the industries we operate in from tire and construction reinforcement technologies to composite technologies.





## Foreword

### ALİ ÇALIŞKAN

#### CEO

Dear Esteemed Partner,

We enjoyed broadened our ability to reinforce in every aspect of life across the first half of 2018. We strengthened our global innovation footprint by striving to produce more efficient and more environment-friendly technologies that make life easier in the three business lines we operate.

We continue our organic growth with R&D and technology investments while seeking for inorganic growth opportunities in composite business globally. With the goal to reinforce one of the leading companies in the composites industry, we will continue to reinforce life through further technological innovations and new investments in composite technologies. We are now striving to become a strategic player in the commercial aviation market as we are in the automotive industry. I whole-heartedly believe that many exciting opportunities await us on our journey to be among the leading suppliers of aerospace and civil aviation industry with our composite technologies. The ongoing acquisition of Fabric Development Inc. (FDI) and Textile Products Inc. (TPI) companies, which are the most important players in aerospace and civil aviation industry in the US, has been finalized. We used to say ‘we reinforce the tires of the aircrafts’; now, we are capable of reinforcing the wings and hulls of those aircrafts with our composite technologies and their landing tracks with our construction reinforcement technologies. Also, with FDI and TPI companies, providing advanced composite fabric products to the American aviation industry, we have taken a very important step towards strengthening our position in the United States. We have now a much more significant opportunity to accelerate our growth and the value we bring to the society to reinforce life.

Additionally, in the first quarter of 2018, our 2017 investments in our other business lines resulted in significant and sustainable returns. In tire reinforcement technologies, we had our polyester cord investment for additional polyester yarn capacity amounting to USD 30 million in Indonesia and Turkey which was first announced in 2016. Our PET Yarn plant in Indonesia have become operational in January 2018, while it will be operational in Turkey at the end of 2018. In construction reinforcement technologies, we started

producing ‘polypropylene monofilament fiber reinforcement’ which offers both sustainable high performance and cost advantages for our customers compared to its benchmarks in the market. We are ready to offer this product both in Turkey and the European market.

It’s with great pride that I can say we have reached over 715 patent applications and over 70 R&D projects. While developing new technologies we also aim to minimize waste by reusing and reprocessing our own waste. We are now providing raw materials to the plastics industry by transforming our by-products that we do not use. We generate the waste accumulated during Nylon 6.6 yarn production process into Nylon 6.6 chips to be used in engineering plastics industry. These raw materials provide resistance to high temperature and abrasion. Thanks to their high chemical resistance and easy-to-process properties, they are being used in different applications in various industries such as electronics, white goods, lighting, automotive interior panels. With this recycling process, while meeting customers need of high quality raw materials, we also create environmental and financial added value. I am proud to say that we are the one and only company in Turkey with this type of waste recycling and we implemented in all of our facilities around the world. Another step-in line with our growth strategy in composites business line, is the commercialization of the production of thermoset prepreg which is an important product in the automotive and aviation industries. While developing many different resin systems for thermoset prepregs applications, we also work on thermoplastic prepreg. We continue to strengthen our position in the market by developing and producing materials of the future that will replace metal due to their lightness, durability and longevity.

We have a rich culture of open innovation focused on developing green innovative technologies and more sustainable products. As a result of this mindset, we joined forces with Continental to establish a new adhesion system for textile reinforcement materials. Thanks to our vision to create collaborative solutions to existing and emerging challenges in the future of mobility, we have been working on this dipping formulation that does not contain Resorcinol and Formaldehyde since 2008. We have leveraged our expertise with Continental and managed to change the 80-year common formula by replacing resorcinol and formaldehyde with eco-friendly chemicals.

We are very proud that our Composite Technologies Center of Excellence already got involved in significant international projects. We are working with many countries and institutions. We are involved in joint projects on producing composite materials with 3D printer technology and the production of nano-enhanced composite repair materials to the aviation sector. We are improving our expertise each day in composites technologies with such co-operations or acquisitions, and yet we are speaking of being among the leading suppliers of the commercial aviation industry.

Thanks to our management model encouraging the development and participation of employees, we have been among top employers in Bahia, Brazil by Great Place to Work Institute for three consecutive years. We were once more selected among “Turkey’s Most Ethical Companies” for the fifth time this year by Ethic Values Center which is given to honor the best performing companies in work ethics.

We remain committed as ever to our philosophy “We Reinforce Life”. We will continue to invest for the future, and to create unique value through innovation, and we will redesign and reshape the industries we operate in, from tire and construction reinforcement technologies to composite technologies.

I would like to, once again, thank you, our partners for your continued support. We know we have to earn the trust and respect of our shareholders, employees, customers and the communities we serve every single day. You can rest assured that we are devoted to doing this. I also want to thank our team having remarkable capabilities, experience and wisdom. I can’t emphasize enough how honored I am to work at this company and with its people.

I wish you an interesting and fun read.



## Schneider Electric Explains the Impact of Digital Transformation on Production and the Economy

**BORA TUNCER**

### Schneider Electric Turkey, Iran and Central Asia Cluster President

#### “Digitalization and energy are like the two sides of the same coin”

*Digitalization and energy are like the two sides of the same coin; very much conjoined. One can not fully evolve without the other. There is a transformation in this field towards de-centralization because the new internet architecture will be a combination of cloud and edge technologies. And the new energy industry is transforming into micro grids, de-centralized, cheaper and more sustainable energy.*

*Mr. Bora Tuncer, Schneider Electric Turkey, Iran and Central Asia Cluster President, and a global expert in energy management and automation, explains Schneider Electric’s take on the major concepts of the era: Industry 4.0 and Internet of Things (IoT) as well as Schneider Electric’s efforts in this area.*

#### “Industry 4.0 is efficiency born from the union of manufacturing and information technologies”

As a global company making innovation for 180 years, Schneider Electric quickly integrates all opportunities technology has to offer to its systems. By extension, we are a close follower of the 4<sup>th</sup> industrial revolution – the 4<sup>th</sup> revolution after the previous three, namely mechanization, serial production and automation – keeping abreast of technological advancements. At Schneider Electric, we view the 4<sup>th</sup> Industrial Revolution, that is Industry 4.0 and the Internet of Things (IoT), not so much as a revolution but as an evolution. And for us, the changes and transformation they bring are a natural reflection of the technological developments which impact every aspect of our lives.

Bidirectional communication of smart devices, which forms the basis of Industry 4.0, is not a novel concept. Devices have for the past five decades been able to sense, generate and transmit data. To illustrate, Schneider Electric invented the first Programmable Logic Controllers (PLC) in 1968. Similarly, concepts such as smart controllers, robotic



applications, smart sensors, big data, cloud computing and cyber security have for long materialized in many aspects of industry and daily lives. These technological developments have turned devices, which previously communicated only locally, into global-scale data exchangers.

Thanks to the rapid uptake of smart phones and social media, information technologies have become accessible to consumers over the past years. While the effect of billions of internet-connected consumers reached gigantic proportions, another tech mega trend was making its way through: the “Internet of Things,” which includes smart and connected machines.

In this context, the Internet of Things is viewed as an evolution, and has, for some time now been continuing to evolve. Remote monitoring and control has for long been relying on the automation of “things,” while the fundamental difference between that and the “Internet of Things” is the sheer number of data-generating devices connected to the internet. The fact that the cost of the IP infrastructure feature fell quite dramatically paved way for all types of devices to be connected. The forecast is that 50 billion “things” will become connected to the internet by 2020.

All this interconnectedness of things creates an enormous pool of data. Thanks to smart controllers, which analyze aforementioned data and make real-time decisions, we can obtain efficiency and flexibility with a minimum margin of error in an infinite number of areas – from manufacturing processes and supply chain to energy distribution and building management. Manufacturers can thus follow what customers demand more closely.

As a result of this evolution, Industry 4.0, is the real-time and big-data based optimization of the entire chain of values in an establishment – from sales to shipment, even to post-sales – under a single roof. In fact, such optimization does not have to be confined to a single establishment, but can bring together collaborating business partners (subsidiary industry, 3PL, etc.) on the same backbone to boost jointly-offered services and efficiency.

At Schneider Electric, we develop products and services in this field under the name of EcoStruxure, in a way that they incorporate all the layers of an Industry 4.0 application. Our solutions under the EcoStruxure architecture are offered in three layers: Internet-connected products, local control (edge control), and applications and services. Leveraging our breadth of know-how in the market and experience in applications, we offer solutions in the six business lines on our target: Building, Power, Data Center, Machine, Plant, and Grid. The EcoStruxure platform enables the interconnection of everything in an establishment between the manufacturing department and the management floor, critical data collection from sensors and the cloud, analyses of the data to create sensible content, and allows to close this cycle with real-time, actionable data. The platform forms the backbone of the technology on which Schneider Electric builds its solutions it offers to users.



**“Internet of Things (IoT) is not about the number of internet-connected objects or machines, it’s about bringing people, processes, data, and things together on a seamless network.”**

To the question of what the future may bring regarding IoT, internet-connected smart tools and machinery will outnumber people using the internet in the near future according to tech world’s forecasts. It is expected that in 2020, nearly 30 billion smart objects will be connected to internet covering everything from smart machines and sensors used in industry to micro sensors used in textiles or packaging.

But the important point here is not the number of objects or machines connected to internet; but that people, processes, data and things will be brought together on a seamless network; because, beyond being connected, this is the only way for valid information to reach the right people at the right time so that Internet of Things can create real value.

As much as we need smart machines and connectedness, we also need software that is able to make big data analyses, and that creates meaningful information from the data at hand. At Schneider Electric we develop solutions with this critical need in mind.



### **Must invest in technology to achieve economic development in Turkey**

Parallel to the process of transformation, which effects the whole world, runs the process of full integration of smart machines and smart factories in big enterprises who think big and who seek global presence. Country-wise, European countries, chiefly among them Germany, and the US have taken some major steps to this end. A host of new generation manufacturing technologies such as the Industrial Internet of Things systems, service-oriented drivers (SOD), and industrial Ethernet networks, which are expected to become widespread manufacturing models of the future, have come to be used.

Turkey, on the other hand, is at the initial stage of this evolution, except large enterprises and big machinery manufacturers. There are no autonomous decision-making mechanisms or integrated plants as such in Turkey. The genes of many fields of science and interdisciplinary studies are waiting to be unified, giving way to technological proliferation.

What makes this transformation inevitable is that the factors underlying the competitiveness of the Turkish industry, such as low labor cost and logistics advantages, will now be under significant pressure. The goal must on the one hand to be to maintain and even improve Turkey’s competitive edge using the Industry 4.0 approach, but more importantly, to create a higher value-added industry in Turkey, which would take a bigger share of the global manufacturing value chain, as underlined in the “TÜSİAD<sup>1</sup> Industry 4.0” report, which Schneider Electric supports with our international experience.

To be able to compete in a race the world started two decades ago, an important prerequisite is to invest in technology. It is estimated that based on current prices and size of the economy annually TRY 10-15 billions of investment (ca 1-1.5% of manufacturers’ revenues) is required in the coming decade in order to incorporate Industry 4.0 technologies to manufacturing processes. It would be impossible to compete against the global economy unless Turkey makes such an investment into technology urgently. In this respect, Turkey’s priorities must lay with human resources as well as technology, and investment in education for Turkish companies to develop themselves.

[1] TÜSİAD is Turkish Industry and Business Association.



## Mass Efficient Transportation

**EGEMEN BİLGE**

**Technology Manager, Kordsa**

Nearly all stakeholders – OEMs, suppliers, governments, and communities – are involved in discussions of efficiency, CO<sup>2</sup> emissions, electrification, drones, new mobility solutions and their effects on our daily life. All these discussions mainly focus on outcomes, such as CO<sup>2</sup> emissions, traffic jams and our daily problems. In order to understand and solve these problems, we should discuss how we would design and create a new world if we started from scratch. In order to start from scratch, we must turn back to the basics. There are two basic terms that lie behind mobility and transportation. These terms are “Mass” and “Work”. All items have mass and mass needs to be transported from point A to point B for specific reasons. The movement or transportation of mass from one place to another is accepted as work. While transporting the mass, we need to consider first the effective mass and then the effective work.

### What is effective mass and work?

For example, imagine we wanted to carry some water or one kilogram of apples. First of all we need a bottle for the water or a bag for the apples.

Then, if we are in a shopping center, we need a trolley and then we need a car to go home. While doing this work we carry the water and kilogram of apples as effective masses, but we also carry ineffective or unrequired masses like the mass of the bottle, bag, trolley and car.

How much mass should we move in order to carry 1 kilogram of these masses – water, oil, apple, computer, mobile phones and people – in today's transportation systems?



Right now, more than 6,000 planes are flying in the air and they are carrying more than 500,000 people. More than half a million people are in the air going from one city to another at any one time of the day. More than 100,000 ships in the sea are carrying goods like mobile phones, cars, oil, consumer goods, and foods, etc. And these ships carry more than 90 percent of what we buy and use in our daily life. There are more than 1.2 billion vehicles on the world's roads and the number is growing each and every year.

Masses need to be transported and there are four main transportation systems: sea, air, rail and road.

Sea transportation is the most carbon efficient mode of transportation. Some large container ships can carry 11,000 containers of cargo, which is nearly 220 kilotons of materials. If that number of containers was loaded on a train it would need to be 77 kilometers or 44 miles long. 130 million containers carrying  $2.6 \times 10^{12}$  kg of material are transported via sea freight every year, and \$400 billion of goods are transported by sea freight globally. If mass efficiency is calculated, it is between 30–45 percent. Net weight cannot be less than 30 percent of the gross tonnage, which means ships are running at a minimum of 30 percent efficiency from the mass point of view.

The second mode of transportation is air transportation, which is very weight and cost conscious. There are more than 100,000 airplanes flying around the world each and every day. Travel distances differ from 2 miles to over 9,000 miles. Commercial airplanes fly an average of 1,430 miles







and a total of 150 million miles per day, which is about 240 million kilometers. During these travels, each plane carries nearly 4.5 kg of mass for each kilogram of goods, people or material. Air transportation is not such a mass-efficient transportation system with 15–30 percent efficiency. Even the Boeing 787 and Airbus 350 have no more than 30 percent mass efficiency, and they have more than 50 percent composites in their body.

Nearly 10 billion kilometers has been traveled by train passengers and 1.5 billion tonnes of material transported last year in this way in the European Union alone. In one subway, more than thousand people can be carried one way. Train weight can vary from 2,000 tons to up to 40,000 tons depending on the allowance limits of the railways in different countries. Therefore, mass efficiency can vary a lot. It can be lower than air transportation in subways, but can be competitive with sea transportation in load-carrying systems.



The last and most popular transportation system is road transportation. More than 1.2 billion vehicles are to be found the world's roads right now, and the number will be around 2 billion by 2035. 95 percent of that number is light duty vehicles, which includes cars. Just last year, nearly 100 million motor vehicles were produced in the world, and this number increases each and every year. 5 trillion kilometers were traveled by car in the United States alone. Let's assume the curb weight of a car is about 1000-1500 kg. Usually, one or two people are travelling in the car. Most cars will be travelling with only one passenger, the driver, and just a few vehicles will be travelling with more than two passengers. Therefore, cars are not usually carrying more than 200 kg. As a result, mass efficiency cannot be higher than 15 percent. In order to move a kilogram of mass from one point to another we have to move approximately eight kilograms in urban areas, meaning the work done is completely inefficient.

**If we are trying to understand our mobility needs we must discover the answers to the following questions.**

**1. How do/will/could people and goods move about?**

Drones and autonomous vehicles are right now the new reality of our world and we should choose the most mass- and energy-efficient transportation systems for sustainability. Besides, we should also think outside the box and we do not have to stick to existing systems/platforms.

**2. How can efficiencies be improved?**

There are lots of ways, and companies are discussing new technologies such as engine technologies, new materials, electrification, car sharing, etc.

**3. How can technology assist travel choices and movement?**

Lightweight technologies and new design capabilities will have more effect on the efficiency of new transportation systems in the near future.

While thinking about mass efficiency, material technologies have a really big effect. Steel is the main material used in all transportation systems. Aluminum is the second most common material. Composite materials are relatively new and are much less common materials in transportation systems.

Material technologies can be and will be one of the important tools for increasing efficiency. Just by switching metal parts for new materials like composites, we can at least double mass efficiency. But it is not easy to directly replace materials. An integrated design approach and specialist knowledge should be applied to create new platforms.

Time is passing very fast and in order to take a lead in the technology, we need a good infrastructure, which our Composites Center of Excellence supplies. But without collaboration and open innovation, we cannot create and reinforce our future world. We have to use our resources – our energy, time and budget – efficiently and wisely. And we do not have enough time to stick to the status quo. We must imagine, realize and reinforce our world together.

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We have a strong team at our Innovation Center and the Kordsa team integrate very effectively. Their cooperation fits with our One Team approach.





## Dunlop – 130 Years of Winning

### JAMES BAILEY

#### Dunlop Motorsport, Consultant

Dunlop was created for one purpose. The goal to win a race. When John Boyd Dunlop developed the pneumatic tire, it was to make his son's tricycle racer go faster, for longer. It won the race, starting a sporting journey that continues, 130 years on.

Dunlop went on to score more wins in the Le Mans 24-hour race than any other tire company. This legacy of proven performance in the world's toughest endurance races mean Dunlop is chosen by top Le Mans prototype squads and Nürburgring 24h teams. Kordsa play a small, but important, role in driving the Dunlop success story.



Motorsport is an arena where the need to control speeds and costs means that many championships have chosen single supplier tire contracts. Formula One, Formula E and most Touring Car series have such control tires. Dunlop do supply some one-brand series, but the brand's main focus is to prove its tires versus the competition, hence the focus on endurance racing which encourages a 'tire war'. This forces Dunlop to experiment with new technologies and new materials, some developed in-house and some in cooperation with partners such as Kordsa.

The 24 Hours of Le Mans and the Nürburgring feature such 'open competition' but the nature of the circuits stand apart from the sanitised template so common at lesser, newer – and shorter – race circuits.

It's no coincidence that Dunlop centres its competition season around these events. The brand, part of Goodyear Dunlop Operations, embraces the relative technical freedom these arenas permit, enticed by the prospect of genuine rivalries.

When the 600 horsepower G-Drive Oreca took LMP2 victory in May's Spa-Francorchamps 6 hours World Endurance Championship (WEC) race, it marked Dunlop's 50<sup>th</sup> win in the championship – more than any other tire company.

The LMP2 class proves a tough environment for tire development. The cars have high levels of downforce and the tires must last several stints. A smart regulation in WEC restricts the number of people who can touch a car during a pit stop. This means a tire change has a far greater penalty than in F1, so the teams ask Dunlop to make tires that can race hard for over 600 km – around 6 times further than a set of F1 tires.



Having evolved the designs during the off-season, Dunlop's engineers work with the teams in testing before setting compounds and constructions for the season. Specifications for this year were decided with intensive testing at Le Castellet, Aragon and Sebring. The work, however, is far from finished with each test or race, as Dunlop engineers work closely with the teams to fine-tune set-ups to get the best performance for each individual team, car and driver combination. Suspension settings and tire pressures directly affect performance in terms of both speed and durability. Lap times are getting faster year after year, but speed is just one requirement from the tires. Dunlop designs rubber for multiple stints, with double-stinting now being taken for granted and triple- or even quadruple-stinting achievable.

Achieving this speed and durability and maintaining desired performance is a challenge. The Goodyear Dunlop Innovation Center works closely with Kordsa in developing new materials. Every element of the tire, whether compound, cord, steel and even the quality of the air inside it needs to work in harmony. If one element doesn't perform to the maximum over a long, demanding race stint, then the whole performance package can be affected.

Therefore, open collaboration is key. This is where the Kordsa relationship matters according to Raphael Beck, Goodyear Dunlop's Global Reinforcement Engineer: "We have a strong team at our Innovation Center and the Kordsa team integrate very effectively. Their cooperation fits with our One Team approach. We are developing materials, and so are Kordsa. The collaboration gives us the opportunity to share resources and we strive to achieve the same goal – winning more races and championships".

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There has been a remarkable increase in the number of people who believe that reinforcing structures saves lives.





## Significance of Reinforcing of Existing Structures and Usage of Composites for This Purpose

**UĞUR ALPARSLAN**

### Global Technology Project Leader

There has been a remarkable increase in the number of people who believe that earthquakes pose a real threat to their lives due to the weak structure of their houses. Most of latter structures are now over 30 years old and in need of urgent structural remedial work. Otherwise, it almost certainly results in loss of life in case of an earthquake. Besides, even if urban transformation was perceived as demolishing and re-constructing within Turkey, technical staff, contractors and municipalities would still be more concerned about reinforcing the buildings owing to both economic and social reasons. It can be undoubtedly said that demolishing, excavating and reconstructing a building would be much more financially taxing and require a much longer time frame than reinforcing a building. Additionally, residents would not want to leave their houses during this period.

For many years, the strengthening or reinforcing of existing concrete structures to resist higher design loads, correct strength loss due to deterioration, correct design or construction deficiencies or increase ductility has traditionally been accomplished using conventional materials and construction techniques but the situations that necessitate reinforcing can be overcome by using composite materials which are known as load carrying materials when used in unison with concrete, steel, masonry and even timber structures. The reasons why composites are being increasingly used as strengthening materials of reinforced concrete elements may be summarized as follows: immunity to corrosion; low weight, resulting in easier application in confined space, elimination of the need for scaffolding and reduction in labor costs; very high tensile strength (both static and long-term, for certain types of FRP materials); stiffness which may be tailored to the design requirements; large deformation capacity; and practically unlimited availability in FRP sizes and FRP geometry and dimensions.

It is a common feeling, among those involved in the application, design, research and development activities in the field of strengthening with fiber-reinforced polymers (FRP), in other words strengthening with composites, that Turkey is developing a strong international reputation both for the value of its contribution in improving the knowledge in this field as well as for the presence of a peculiar and important building

heritage. This includes those of historical and architectural relevance as well as more recent masonry, reinforced concrete, pre-stressed concrete, timber structures and steel structures.

Composites in building and infrastructure have a wide range of usage areas as facade, profiles and reinforcing materials throughout the world whereas in Turkey, they are only being used for reinforcing projects in the construction materials market. This method confers a significant advantage over conventional reinforcing methods, which represent concrete, heavy steel or other materials.

The growing interest in FRP systems for strengthening and reinforcing can be attributed to many factors. Although the fibers and resins used in FRP systems are relatively expensive in comparison to traditional strengthening materials, the labor and equipment costs incurred in FRP system installation are often lower. FRP systems can also be used in areas with limited access where traditional techniques would be difficult to implement. After the Kocaeli earthquake in 1999, Kordsa's warehouses and other buildings at the production site were unfortunately damaged due to the seismic loads. Reinforcing material was chosen as steel plate because this material was unique at that time. Choosing steel as material introduced drawbacks such as the increased weight of steel; the steel plates must be welded together; resulting in a considerable increase in overall thickness due to the protective jacket of concrete. To add to that, being heavier than the composites leads to more labor, power and quality problems when reinforcing a concrete member that has a complex geometry. It is not easy to form steel plates as needed whereas composites can be manufactured in the desired shape and the concrete can be wrapped perfectly.

### APPLICATION

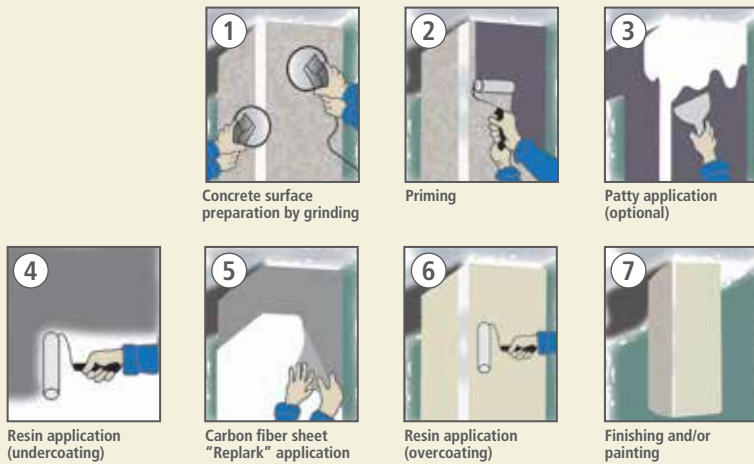
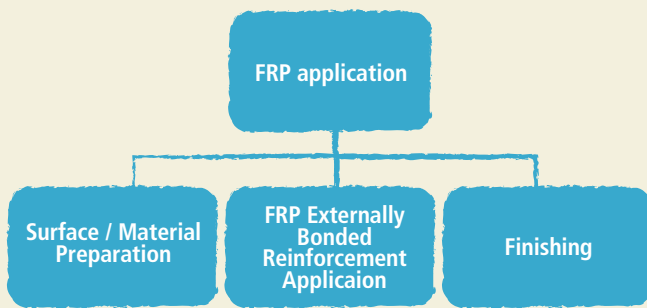
There are various types of manufacturing processes that include Hand Lay-up/Spray-up, Resin Transfer Molding (RTM), Compression Molding, Injection Molding, Reinforced Reaction Injection Molding (RRIM), Pultrusion, Filament Winding, Vacuum Assisted RTM (Va-RTM), Centrifugal Casting. Each of which is specialized for a target industry with different purposes such as structural or aesthetic. In the construction sector, the basic FRP strengthening technique, which is most widely applied, involves the manual application of either hand lay-up or cold cured prefabricated systems (pultrusion) by using only adhesive bonding because concrete or any other load bearing member's geometry can be utterly complex. Also, less equipment, less energy and time should be used. Common in these techniques is having the external reinforcement bonded onto the concrete surface with the fibres as parallel as practically possible to the direction of principal tensile stresses. The hand lay-up technique is the most popular one because pultrusion is not suitable to properly wrap rectangular or square shaped cross-sections while reinforcing by hand lay-up, whole areas of beams and columns are fully covered and strengthened. Thus, pultrusion does not substitute hand lay-up.

Process characteristics of hand lay-up are given below;

• MAX SIZE:	Unlimited
• PART GEOMETRY:	Simple - Complex
• PRODUCTION VOLUME:	Low - Medium
• CYCLE TIME:	Slow
• SURFACE FINISH:	Good - Excellent
• TOOLING COST:	Low
• EQUIPMENT COST:	Low

Reinforcing a building by hand lay-up means that dry fabric is laminated with thermoplastic or thermoset resins. In general, two components (epoxy resin-hardener) have been used because of their physical and mechanical properties and bonding capabilities with fiber. To enhance the reinforcing level, carbon fibers are commonly preferred. Fibers can also be selected among boron, glass, aramid, and even polyolefin groups but carbon fibers have outstanding mechanical properties under tension stresses. Therefore, they are preferred notwithstanding the relatively higher cost. Meanwhile, the fabric's structure should be unidirectional (UD). This is only because of load transfer mechanics among the layers.

Installation steps of carbon fiber reinforced polymers are given as follows;



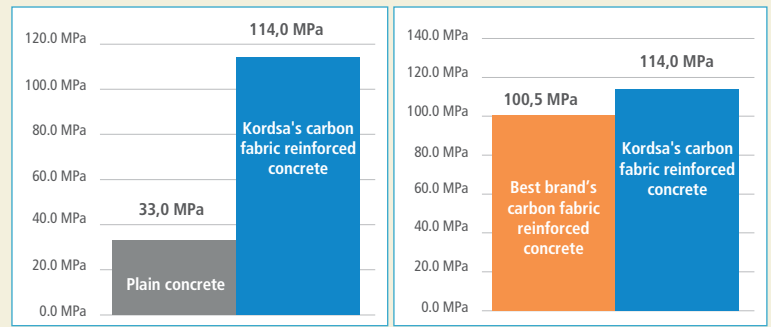
Surface preparation is paramount, at least lamination of fabric or curing processes. If detected, weak concrete and contaminations, roughened surfaces, rounded corners should be removed and made dust free because the bond quality is influenced by the condition of the existing concrete. Rounding corners to a radius of at least 30mm is an indispensable part of this process providing a uniform load distribution. For this reason, excessive stresses are transferred to the FRP layers in the pointed corners of the section.

If the reinforced concrete surface has surface defects due to the low compacting effort in casting of the concrete, the surfaces are filled and smoothed with epoxy putty having a thixotropic characteristic. After this step, there should be no gap between the reinforced concrete and CFRP layers.

After the primer and putty application and the material preparation (cutting of fabric and weighing of epoxy), application of fiber reinforced polymer can be started. In this step, the epoxy and hardener mixture are applied to the fabric to laminate it hence removing the air gaps between the fabric and the concrete. Removing air from the composite layers is essential in reducing the load transfer between composite layers and/or concrete. Because of the innate characteristics of the hand lay-up method, from time to time, impregnation could be insufficient (delamination of plies, debonding from the surface, etc.) Therefore, special hand tools are used for this purpose.

### TESTING AND DESIGNING OF COMPOSITES

Basically, the CFRP layers are beneficial in terms of load carrying in three ways; confinement, flexural contribution and shear contribution. One important application of FRP composites is as wraps or jackets for the confinement of reinforced concrete (RC) columns for enhanced strength and ductility. In FRP-confined concrete subject to axial compression, the FRP is principally loaded in hoop tension while the concrete is loaded in tri-axial compression, so that both materials strengths are taken advantage of. Both the strength and the ultimate strain of concrete can be greatly enhanced as a result of CFRP (Carbon fiber reinforced polymer) confinement, while the high tensile strength of CFRP can be fully utilised. Instead of the brittle behaviour exhibited by both materials, CFRP confined concrete possesses greatly enhanced ductility.



It is obvious that after wrapping with CFRP materials the concrete samples undergo a massive change in their load bearing capacity. As seen in Figure, owing to the changing boundary conditions of concrete members after more than one ply of CFRP, their compressive load bearing capacity has improved up to almost 3,5 times. Moreover, when comparing Kordsa's fabric and the best fabric on the market, a 12% difference can be distinguished.



Figure 1: CFRP reinforced cylinder concrete sample, after compression test

The second crucial application of FRP composites is the increasing load bearing capacity of concrete members under bending forces for enhanced strength and ductility. In CFRP-confined concrete subject to bending moment, the CFRP is principally loaded in hoop tension again as confined sections. To measure the flexural contribution as mentioned in introduction how effective CFRP layers, ASTM C 1609 tests were carried out.



Figure 2: Bending test of CFRP reinforced concrete prism sample

The test results reveal that CFRP materials that are externally bonded to any surface show outstanding performance as seen in the graph. The green circle represents the point at which the concrete cracks. It is almost the same level for all concrete samples including those reinforced by fiber or composite materials in terms of deflection and bending force. The difference between both plain concrete-CFRP reinforced concrete and fiber reinforced concrete and CFRP reinforced concrete can be easily comprehended.

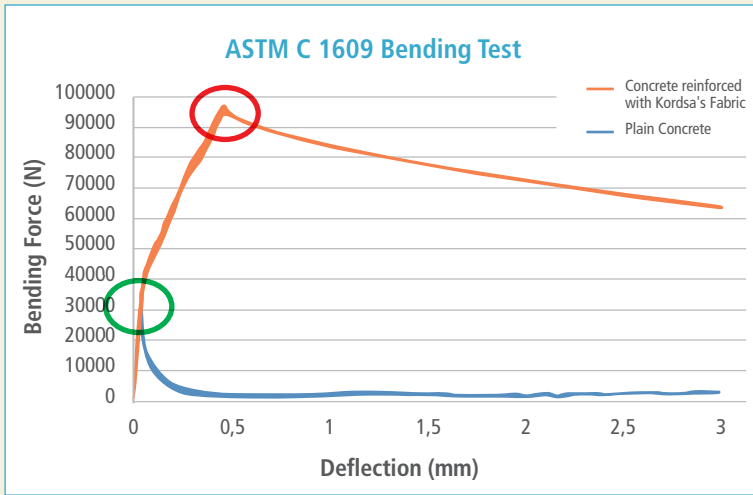


Figure 3: Comparison of plain concrete and CFRP reinforced concrete by using Kordsa's fabric

As for red circle, it is the point that CFRP layers start to separate from the concrete surface. The bending force-deflection curve of CFRP reinforced concrete (orange line in graph) would continue to climb up to the end of the test in case of using dowels.

There are various failure modes of FRP reinforced concrete but a critical issue unites all of them at the same point. As seen below with different figures, FRP layers tend to debond from a concrete surface without any deformation on them because of the fact that they are strong enough whereas concrete starts to crack and propagates.

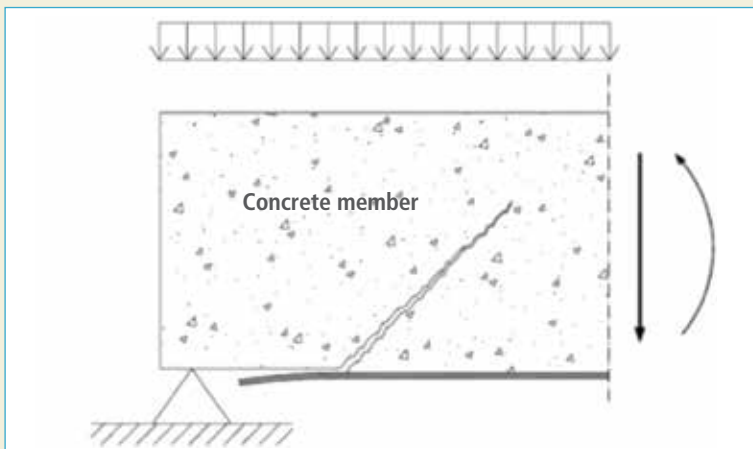


Figure 4: Debonding by diagonal shear crack

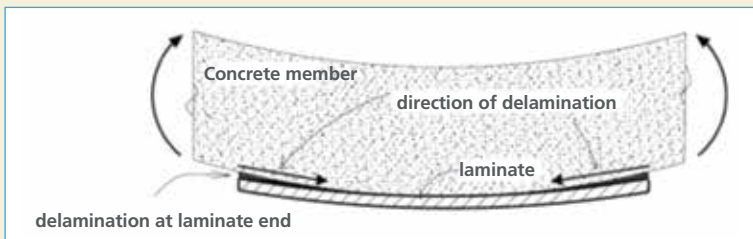


Figure 5: Plate end debonding

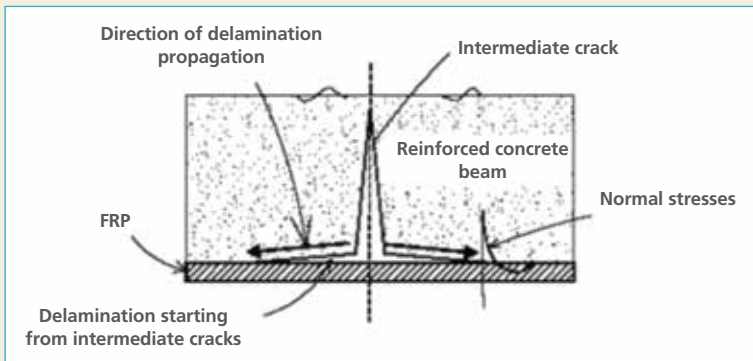


Figure 6: Debonding starting from vertical cracks in concrete

ASTM, ISO and EN tests related to reinforcement of a building are possible to be carried out in Kordsa's R&D Center, Izmit and Composite Technologies Center of Excellence, Istanbul (Kompozit Teknolojiler Mükemmeliyet Merkezi), Istanbul is well equipped with test devices with the purpose of developing composite materials. Results from any test including composite coupon test and composite reinforced concrete tests, Kordsa's carbon fabric shows at least 10% better performance without increasing the cost of product.

A carbon fabric and epoxy kit have been developed within a project, along with Construction and Composite reinforcement platforms. After lab scale studies, a full scale application has been done to reinforce a concrete slab and its beam. The design of the in-situ application of CFRP (number of plies, reinforcing type and thickness of composite) has been done by Construction R&D team. Laboratory test results also shed light on the design aspect of the level of carbon fabric's load bearing capacity. The most frequently used algorithm throughout the world, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures ACI 440.2R, was followed to determine the reinforcement. The shear contribution of the CFRP can be then calculated from equations in this guide; shear force capacity is increased approximately 40 tones-f with the application just 2 plies of composite.



Figure 7: A full-scale application, reinforcing of a concrete beam

According to the voice of a potential customer and end user, Kordsa is found more advantageous than other companies that sell the same sorts of products in terms of lead time, sustainability of quality, onsite user friendliness during application. Manufacturing fabric in Kocaeli means reducing delivering time by 8 compared to importing it from other countries. Korea and China dominate the market but in general end users frequently face quality problems. This material is being installed to reinforce buildings and to save lives. Therefore, the best quality must be sustained for CFRP materials.

Concluding from lab scale studies over a three-year period and field application, it can be said that a new carbon fabric has been successfully created for a reinforcing field and are ready to be brought to the market. To sum up, Kordsa's carbon fabric is herein applicable for load carrying in accordance with ACI, Eurocode and Turkish Earthquake Code.

## FUTURE WORKS

No company in Turkey and only a limited number of companies throughout the world can manufacture prepregs and pultruded sections, especially thermoplastic ones for construction materials. Thanks to playing manufacturer, innovator and leading roles in construction and composite materials fields, Kordsa will pioneer other materials and technologies. The presence of sufficient R&D facilities, knowledge, textile producing experience help us to reach targets. In other words, Kordsa will continue to reinforce every aspect of life.

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What we expect from our jeans is that we not only look good in them anymore, but that they also keep us warm in the winter, and cool in the summer, increase our blood circulation while tracking our steps, monitor our health indicators, adapt their color to the environment, and even do not idle while we are walking and give us a massage...







## Wearable Technologies and the Future of Fashion

**ARZU KAPROL**

### Fashion Designer

We are witnessing a period where the dominance of a single color or pattern in a season, or the question, what is in fashion this year, has become obsolete.

Life and technology are now intertwined and mutually nourishing more than ever.

What we expect from our jeans is that we not only look good in them anymore, but that they also keep us warm in the winter, and cool in the summer, increase our blood circulation while tracking our steps, monitor our health indicators, adapt their color to the environment, and even do not idle while we are walking and give us a massage... Our expectation for performance has never been this high. The good news is that these are all feasible expectations.

Let's first refresh our memories on the more recent past:

It was in the 1960s that we first started to talk about the future and fashion in the same context. The turning points were the first foot set on the moon, and then the start of the millennium in 2000. As the millennium drew closer, while there were fake news on how computers and programs written in different codes would crash, the real influence started to be observed strongly in video clips, fashion and the music industry.

Since fashion production is a process starting from fiber, and continuing with yarn, dye, fabric, sewing and wearing, it requires long-term planning. Therefore, trends, trade shows and the industry have to be ready for the seasons well ahead of time. The welcoming of the millennium occurred just as expected in fashion: metallic surfaces on fabrics, polished fabrics with space effects, clothes with rigid and sharp forms, large collars, robotic bionic cuts, leathers, hard but subtle shoulder pads... Along with sort of an updated version of Star Trek, the new millennium promised a future, hope and novelties in yet uncharted extraterrestrial land.

In 2001, one event completely changed this feeling of hope: the 9/11 attacks on the Twin Towers. Attacks that were somewhat familiar to us, those living in a region of the world closest to the Middle East, but unprecedented for those in New York and in the Western world. The feeling of safety was shaken in the West. Once the feeling of safety is shaken in a person, everything new instills fear – the new always takes

courage. In the absence of safety, there is no courage, when there is no courage, there is nothing new, and when there is nothing new, a new movement, or trend or the space-millennium fashion is suddenly off the agenda. That is exactly why the vintage trend appeared. Instead of the uncharted waters of the future, fashion turned to the past, and clothes from the past, those of our parents and grandparents came to the fore, and the need for guaranteed happiness and a reliable past gave people the strength to hold on to life. The same feeling prevailed in music – after all the music with laser effects, suddenly Norah Jones's hit Unplugged swept all the Grammy Awards that year.

Safety concerns have not diminished since then, but technology and the textile industry have adapted to the change. The need to access information and communicate anytime radically changed all clothing, entertainment, consumption means. We have grown used to everything in our lives being smart and connected, their turning on and off on their own, giving us direction and precision, being liked and being seen, and enabling us to access and be accessible no matter what. Today, our expectations of fashion are no less than that. We expect our wardrobe to know our consumption habits, roughly estimate the product lifetime of our most recently purchased black pants and t-shirt and remind us of it, and even order new ones by themselves. We plan for our car, parked in the garage, to go and pick up the order by itself.

Today, our clothes and everything we consume have to meet extremely high performance expectations. As one side is producing single-use products to meet the fastest consumption need, the other is seeking for fabrics and designs that will not wear out for a lifetime. Designers try to adopt a multidisciplinary approach to combine all disciplines. Music, arts, biology, chemistry, electronics, all merge in a single point of view. We are in the search for special clothes that will not wear out and will adapt to all kinds of climate conditions for bodies that resist mortality, or a parallel universe and parallel lives made possible with specially equipped clothes that will make us sense everything in a virtual reality.

The design industry has long joined forces. Since 2015, when my designer friends and I together designed for Vodafone Turkey the jacket that changes its form according to weather conditions, our priority has been a multidisciplinary approach. While we were designing the jacket, we worked in a team including an electronic engineer, a genetic scientist, a sculptor, an electronic software expert and a fashion designer at a textile workshop where electronic circuits could be integrated.

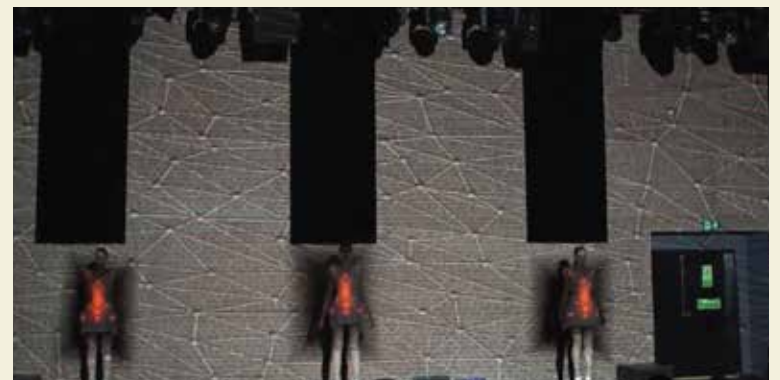
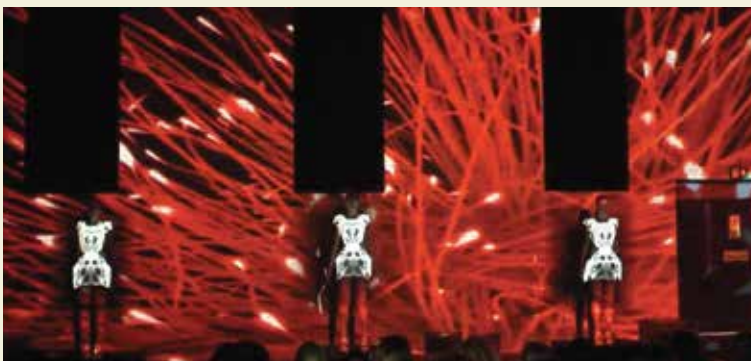
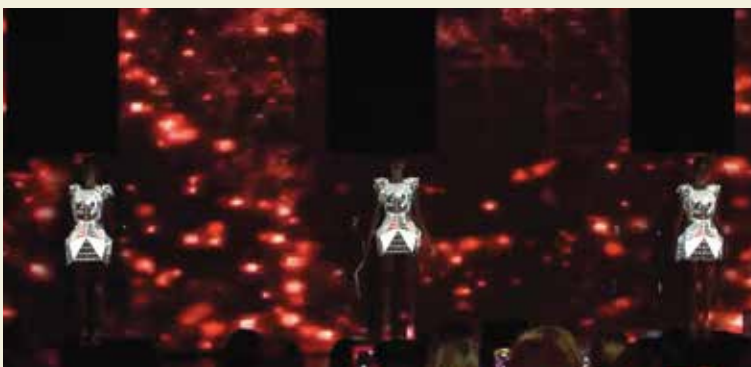




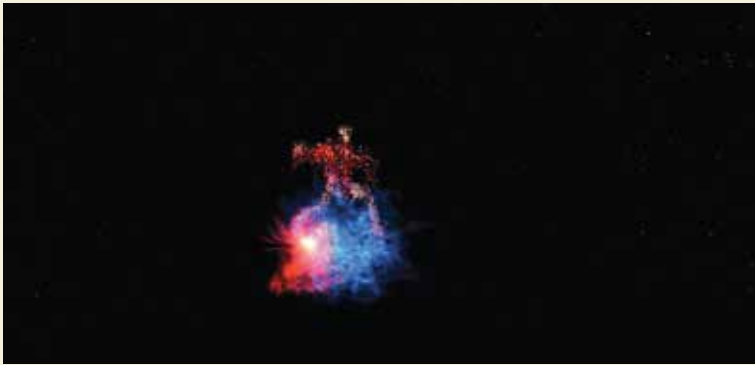
The jacket adapts to the weather in a defined space. It becomes shorter, its hood collapses, and it transfers the energy it collects through solar panels to the cooling units on the wrists to cool the body in the summer, and in the winter, it becomes longer, the hood and front panels expand to cover the body, and this time the solar panels give out heat from the nape to warm the body. In case of an emergency, the GPRS technology on it serves to send location information to 3 addresses predefined by the user.



Design has now gone beyond designing clothes only, and has turned to create space and presentation areas. There is an expectation for mind-blowing speed and pleasure in communication and esthetic presentation techniques. Clothes we create with 3D printers have reached an esthetic value integrity at our shows that we were not able to achieve with conventional techniques.



At our show where we presented clothes that had been designed and produced with the 3D printer technology, 1500 different patterns were projected onto these clothes and shared with our guests.



Following that, at our most recent show that was watched completely with VR glasses, viewers came to the venue and watched the show through virtual reality glasses they were given, and experienced a 360 and 3D show against a backdrop ranging from the space to the Basilica Cistern.

Can fashion and design suffice with anything less after all these developments? Of course not.

For instance, we have swimsuits now that clean the sea while we are swimming, and maybe the next step will be cleaning the air while walking.



Huffpost, Carla Herrera, This Bikini Of The Future Cleans The Ocean As You Swim, 10/12/2015  
[https://www.huffingtonpost.com/entry/spongesuit-cleans-ocean\\_us\\_56244797e4b02f6a900cc63a](https://www.huffingtonpost.com/entry/spongesuit-cleans-ocean_us_56244797e4b02f6a900cc63a)

Can cities become cleaner this way? Why not? Today, we have to consider everything in a multidimensional and multidisciplinary fashion.

Perhaps designers will soon design variable data and sell them online, and the 3D printing store on the corner will print it specifically for us according to the shape of our body.

All of these are possible right now.

With their biggest fear of living and ageing, human beings are competing against life with all their creativity.

While all technologies are advancing, perhaps our most significant responsibility is the fact that we are creating a future with the human being at its heart.

A country like Turkey, where most of the labor force is employed in the textile industry, has to adapt to all this rapidly. Sustainability will perhaps mean producing clothes for Tesla's mission to Mars in the near future or training textile workers that can connect electronic circuits - because the future is shaped as we speak and is already past.

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It was a warm day and we were going around with my two guests from Serbia in the Bazaar area of Istanbul. We had finished a meeting and had several hours in the afternoon until their time to fly back home in early evening.





## Sales People on the Go!

### VAHE HANAMIRIAN

#### Global Accounts and Marketing Director, Kordsa

Sometimes I think that while executing my job, I gathered a lot of experience in travelling. I could even claim that we salespeople are professional travellers. I have experienced a lot of cases which are quite useful to my fellow travellers.

#### WHAT DO YOU DO IF YOU LOSE YOUR PASSPORT WHEN YOU ARE ABROAD?

It was a warm day and we were going around with my two guests from Serbia in the Bazaar area of Istanbul. We had finished a meeting and had several hours in the afternoon until their time to fly back home in early evening. The Bazaar area in Istanbul is a good place to spend some time for foreigners and native as well. We were enjoying the surrounding small souvenir shops.

As mentioned it was a warm day and my guests had taken off their jackets. One of them liked a small souvenir and when he wanted to pay, he noticed in big pain that his wallet and his passport were stolen from his jackets pocket. We were all shocked, the wallet with some money inside was a problem but a bigger problem was to lose the passport which he needed to fly back home.

I was also helpless and did not know what to do. One shopkeeper proposed that we rush to a police station. We started running, maybe we had a chance to catch the thief. But, after some hundred meters, I noticed that one of my guests was lost. So, we had to stop and look for him in the crowded bazaar area. I told to myself; what a day, one of my guests lost his passport and the other one lost himself. Finally we found each other and went to the police station. The police were very helpful but could only help with documents. We got a copy of a document confirming the case and rushed to the Serbian Embassy quite far away.

Well, the process is; with the document from the police you apply at your embassy and they for a document which helps you fly back home. Of course the story is longer as we had to find a photo shop and make some photos of my guest for the document etc. and not to forget that the friendly staff in the embassy proposed a good quality local wine for

all the help I did for my guest. But, in the end my guest had the document to fly back and I had a good experience of how to proceed if you lose a passport.

#### WHAT DO YOU DO IF THE GEOGRAPHY CHANGES?

We had a customer in the northern part of Slovakia (or better Czechoslovakia) for whom the easiest way to go was to fly to Vienna, rent a car and drive several hundred kilometres. We had done this trip several times a year and were quite used to the beautiful local roads.

One day, the trip began as mentioned. We, four of us, rented a car in Vienna and entered Slovakia with a different visa that time as the country Czechoslovakia was separated into two Czech and Slovakia. The Geography had changed, we knew this but not the consequences. We now had a visa for Slovakia but no need for one for the Czechia (or the name: Czech Republic at that time). We were having a pleasant drive when I suddenly had a feeling that something was wrong. Some labels in local language were somehow warning.



Later, I understood that the labels were telling that we were driving to the Czechia and there was no return. Our usual road was now entering Czechia for some kilometers and then continuing to Slovakia. We did not have the required visas to enter that stretch of road. But the biggest problem was that we had a visa for Slovakia just for a single entry. So, if we left, we could not come back in!!

We could not enter Czechia and also could not re-enter Slovakia. I started to think that it would be a good Hollywood movie, in which some people would live in the neutral no man's land between two neighbouring borders for some years. Maybe this would be our destiny.

Fortunately it was not that bad. One very friendly guard at the Czech border could speak good German. We got him to understand the situation and he brought us back in the other direction. I told him that part of the problem was solved and we could go back to Slovakia but what would happen at the Slovakian border; we just had a single entry visa and we had already entered Slovakia once. He smiled and told that he would call his colleagues there and let them understand that they let us in without an official stamp. He had kept his promise, the guards at the Slovakian border were laughing when we were there. It was probably also a change in their usual daily routine.

First thing we did was drive into a small town and buy a big map of the whole area. We were lucky once but could have bigger issues a second time round. So, we selected roads which were 100% inside Slovakian territory.

# WE REINFORCE LIFE

## News

### Kordsa Acquires Fabric Development Inc and Textile Products Inc in the US



Kordsa continues its organic growth with R&D and technology investments while seeking for inorganic growth opportunities in composite business globally. Recently, Kordsa announced the acquisition of Fabric Development Inc. (FDI) and Textile Products Inc. (TPI), which provide advanced composite materials to the commercial aviation industry, with an investment of USD 100 million. Kordsa sees this opportunity as a very important step towards reinforcing its composite market position in the US as well as becoming a strong player in the growing aviation industry supply chain.

Kordsa CEO Ali Çalışkan said: "This new step will ensure us to be a strategic supplier of key players in aerospace and civil aviation, particularly Boeing and Toray Composites Materials America Inc. With this acquisition, we also aim to strengthen our strong global leadership in reinforcement technologies. We used to reinforce the tires of the aircrafts, now we are honored to say that we will also reinforce the wings and hulls of the aircrafts with our composite technologies, as well as the landing tracks of those aircrafts with our construction reinforcement technologies. Kordsa, now operating in 10 facilities throughout 4 continents, will continue to reinforce life and take firm steps forward."

### Kordsa's Composite Manufacturing Facility Certified for Quality and Risk Management in Aerospace and Defense Industry

Reinforcement technologies' leader Kordsa's manufacturing facility at Composite Technologies Center of Excellence, a technology hub inaugurated in cooperation with Sabancı University to bring industry and university together under the same roof, received BS EN ISO 9001:2015 ve EN 9100:2016 (AS9100D) certification, which is an international standard for quality and risk management in the aerospace and defense industry.

This certificate, confirms Kordsa's commitment to high quality service to domestic and global customers in the aerospace and defense industries, will be a major advantage in realizing the company's targets in the aerospace industry.



### BizBize Meetings Started in Kordsa



BizBize management dialogue meetings, where all factory workers come together with the top management in Kordsa Turkey, started. In the meeting, while sharing information about goals and investments of Kordsa, on the one hand, activities were organized that bring creativity and teamwork at the forefront, on the other hand.

## Kordsa Redefines the Good Life with Arzu Kaprol at Sustainable Brands 2018 Istanbul.



Held on April 18-19 at Fairmont Quasar Istanbul, this year's theme of the Sustainable Brands was "Redefining the Good Life." Kordsa's Business and Market Development Director and Construction Business Leader Murat Oğuz Arcan participated as a panellist together with fashion designer Arzu Kaprol in a panel organized as part of Sustainable Brands 2018. The panel topic was "Designing the Future with Technology".

Arcan mentioned that Kordsa developed environment-friendly technologies contributing to a sustainable future while reinforcing life and redefining the good life and continued: "The future is ahead of us. It will come inevitably. However instead of waiting for the future to reveal itself, how about being a pioneer, and shaping it yourself?" Arzu Kaprol is one of the important figures who shapes the future and our paths intersect precisely at this point. We redesign and reshape the industries we operate in, from tire and construction reinforcement technologies to composite technologies in technical textile. As Kordsa, we strive to develop 'sustainable technologies' with each step we take on our journey and every investment we make with the aim of 'We Reinforce Life'. As a brand exporting technology to the world, we are working to produce more efficient and more environment-friendly technologies that make life easier in the three areas we operate."

## Kordsa Participated in the World's Biggest Composite Technology Show



Kordsa attended JEC World 2018, the biggest composite technology show in the world. The reinforcement leader shared its expanding product portfolio and new technologies with the visitors. Kordsa's CEO, Ali Çalışkan, was one of the jury members evaluating a total of 30 projects in 10 different categories at JEC Innovation Awards Ceremony, which took place as part of the JEC World 2018 to celebrate and honor the outstanding innovations of the industry.

In his speech at the ceremony, CEO Ali Çalışkan emphasized Kordsa's mission to reinforce life and said: "This year, we are the official partner of the ceremony of the JEC Innovation Awards, which evaluates 30 impressive projects. As a member of a brand that embraces open innovation, I believe that every project in the competition, whether it is awarded or not, will be a significant

contribution to the industry. On behalf of my company, Kordsa, it was an honorable experience for me to be among the members of the jury, evaluating these projects."

"Today we export our technology to the whole world, we cooperate with brands and realized innovative projects in the global market. We strengthen our global reputation as "The Reinforcer" with the awards we receive. We reshape the industry with game-changing innovations, thanks to our open innovation mindset. By the end of 2017 there were 664 patent applications worldwide, of which 168 were registered. We are leading the way globally in terms of new products, processes and equipment. With the goal to be one of the leading companies in the composites industry, we will continue to reinforce life through further technological innovations and new investments."

## Kordsa Presented its Composite Technologies That Lighten Vehicles at the Michelin Movin'On Conference



Kordsa attended the Movin'On Conference in Montreal. At the conference, formerly known as Michelin Challenge Bibendum, held by Michelin for more than 20 years, Kordsa made a presentation that emphasizes the need to lighten vehicles for efficient and sustainable mobility. Kordsa's presentation also covered the differences that they could make in mobility with their composite technologies developed through their open innovation approach.

Kordsa, the reinforcer of 1 out of every 3 automobile tires and 2 out of every 3 aircraft tires worldwide today, highlighted current issues of mobility and its suggestions to solve them; emphasized the need to lighten vehicles for efficient and sustainable mobility by using heavy vehicles to move a mass from one place to another. The presentation also underlined the future of mobility, and how to make mobility more efficient in the future as well as Kordsa's aim to reduce rolling resistance to decrease fuel consumption with its tire reinforcement technologies and to lighten vehicles with its composite technologies in order to achieve more sustainable mobility.

Kordsa, a key supporter of the open innovation model, contributes to the future of mobility by developing composite technologies in a wide range of industries from aerospace to automotive today and thus support the future of mobility by lightening the vehicles in Composite Technologies Center of Excellence which serves as a technology hub.

## Kordsa's All Stars Awards Found Their Owners for the 12<sup>th</sup> Time



The 2017 All Stars Awards in Kordsa, have found their owners for the 12<sup>th</sup> time. The rewarding system aims to recognize the improvement and innovation efforts within the company, as well as encourage and inspire other employees. The ceremony was hosted by Kordsa's Izmit facility with live connections to Kordsa companies in USA, Brazil, Thailand and Indonesia.

The number of competing projects at the All Stars Awards increases incrementally each year and the jury had to choose the best from 129 candidates and 1163 projects for this year's event. Kordsa's facilities were evaluated based on their cost improvement, best financial performance, and best safety performance, whereas for individual awards, Kordsa employees' projects were evaluated in terms of innovation approach, best development, best project team, global synergy, cost projects, commercial approval of patents and TPM studies.

## Kordsa at Tire Tech Expo 2018

Kordsa exhibited its innovative products and tire reinforcement materials at the Tire Tech Expo 2018, in Hannover, Germany on February 20-22, which hosts world's leading suppliers to tire manufacturing as one of the world's premier tire technology showcases.

Kordsa and Continental introduced a new, sustainable adhesion standard for tire reinforcement materials, which they developed conjointly, at the Tire Tech Expo 2018, in Hannover, Germany on February 20-22, which. The new eco-friendly technology is regarded as a milestone for the industry since it is a sustainable alternative to the 80 year-old established formula. Via the free licensing concept, Kordsa and Continental aim to make the RF free technology industry's new adhesion standard for textile reinforcing materials.

As part of the Tire Tech, Kordsa also gave a course titled "Tire Reinforcing Materials Applications and Fatigue Testing". Attendees had the chance to expand their professional and personal knowledge on the latest materials and their performance in the tire reinforcement industry.



## Kordsa Attended the Global Entrepreneurship Congress

Kordsa sponsored the Global Entrepreneurship Congress, amongst the most important summits of the global entrepreneurship ecosystem. At the "The Fourth Industrial Revolution" panel, Kordsa shared with participants its global collaborations and technologies, which reflect its open innovation mindset.

At the awards ceremony held on Monday, April 16<sup>th</sup>, the participants enjoyed a composite cello performance, reinforced and lightened by Kordsa technologies. Kordsa also sponsored the "The Future of Transportation and Space" workshop.

Kordsa COO, Composites, Construction and Business Development, Murat Oğuz Arcan spoke in the Fourth Industrial Revolution panel and emphasized that Kordsa had expanded its line of business through investing in innovation and technology.



Arcan continued: Over the past decade, we have focused on research and development on automation, data collection, data security and sensor technologies. Thanks to our strategic partnerships, we successfully implement sensor technologies at all our sites. We redefine the quality of production with our smart production systems and increase the speed of production with fewer mistakes. Our products and technologies enable us to touch every aspect of life, making it safer, and more robust with higher performance. We contribute to building stronger and safer buildings with our construction reinforcement technologies while improving the tire grip and reducing the rolling resistance in tire reinforcement technologies. We reduce fuel consumption lightening the vehicles with our composite technologies.



## Kordsa Commissions New Production Line Creating Added Value to Its Infrastructure Projects



Inaugurated in December 2017, Kordsa's new production line of polypropylene monofilament fiber reinforcement, which is based in Kordsa's Izmit plant, became operational in June 2018. With this new investment in construction reinforcement technologies, Kordsa does not only increase its production capacity but also expands its product range.

Kordsa has been making a difference in the construction market since 2014 with its innovative macro and micro synthetic fiber reinforcement products that provide ease-of-use, quick applicability, reduced labor cost, increased equipment and energy efficiency, high concrete toughness, long-durability and low carbon emissions for concrete reinforcement applications in construction projects. Kordsa differentiates its new product in terms of cost advantage by using an effective dosage as well as providing sustainability and high performance, especially in infrastructure projects.

## Kordsa Brazil Received ISO 14001 Environmental Management Systems Certificate

Kordsa's dedication to carry out its operations and projects with people and nature at the core, is standardized with respect to the ISO 14001 Environmental Management Systems Standard, which results in efficient use of natural resources like energy and water, conservation of biodiversity and combatting climate change for all Kordsa plants. Kordsa's plant in Turkey and Indonesia received ISO 14001 certification in 2017. In the beginning of 2018 Kordsa Brazil also obtained ISO 14001 certification, successfully completing environmental management system audits. Kordsa's Thailand, and US plants are on the way.



## Kordsa has Launched the New Cord Manufacturing System



Kordsa has launched the Taks+ project in Indonesia to increase quality and productivity in its manufacturing processes. The project, which is an outcome of operational excellence approach, has allowed transferring the data collection, monitoring and tracking systems in manufacturing sites to digital media.

## Kordsa's "Improvement Awards" Found their Owners



Within the scope of the "Improvement Awards", Kordsa awarded the best individual proposals and projects of 2017 presented by Kordsa Reinforcers. Improvement studies conducted to find permanent solutions to achieve the goal of zero accident, to resolve quality problems and to prevent the recurrence of any kind of malfunction in Kordsa also ensure sharing and embracing responsibilities by all employees.

## Kordsa and Sabancı University Hosted the Consulate General Officials from Different Countries

Together with Sabancı University, Kordsa hosted the Consulate General officials of the United States, Brazil, the Netherlands, Austria, Australia, France and Italy at the Composite Technologies Center of Excellence. The capabilities of the center were shared with the participants and information was exchanged about the works that could be carried out cooperatively. The visit came to an end with a laboratory tour.



## Kordsa Meets the Representatives of Holland Innovation Network



Kordsa met the representatives of Holland Innovation Network at the Composite Technologies Center of Excellence. Within the scope of the visit, a tour at the manufacturing center and R&D center, where Kordsa makes a serial production of prepreg, fabric and panel materials for the composite sector, was made and opportunities for cooperation were evaluated.

## Kordsa Meets Investors on Sabancı Industry Day

Kordsa met with analysts within the scope of Sabancı Industry Day. Kordsa shared information about the developments in tire, construction reinforcement and composite technologies, as well as its investments and objectives in 2018 and answered the questions of analysts.



# WE REINFORCE LIFE

## Awards

### Kordsa Once Again Amongst 100 Fastest Growing Companies in Indonesia

Kordsa strives to attain sustainable growth in every country it operates and provide products and technologies that create value to its customers. As an output of these efforts, Kordsa is once again among the top 100 companies out of 355 publicly listed companies by Infobank, one of Indonesia's prominent economics magazines.

Indo Kordsa was considered successfully growing by posting positive earnings amid the pressure of an economic downturn, micro pessimism, and disruption.

Raden Wahyu Yuniarto, Human Resources and Information Technologies Group Manager of Indo Kordsa, received the award, given at the ceremony held at the Jakarta Stock exchange.

With an aim to reinforce life, the future and society, Kordsa will continue to positively impact every geography it operates in and to develop innovative reinforcement technologies that create value.



### Kordsa is Among the Best Employers in Brazil for the Third Consecutive Year



Kordsa, reinforces its success and continues to establish its "Reinforcer" reputation through the awards granted in many countries as well as in Turkey. Kordsa's facility in Brazil has been listed amongst the best employers for the third time in Brazil by the Great Place to Work Institute (GPTW). Kordsa has been ranked 4<sup>th</sup> place in Bahia, Brazil. Kordsa Brazil was the only industrial company to be included on the list.

Kordsa CEO, Ali Çalışkan said about their success for the last three years: "We have been among top-ranked companies for the last three years in this survey conducted by Great Place to Work Institute. This recognition is an output of the steps we take towards becoming a global employer brand. We see our human resources as our greatest asset. Our human resources approach has five pillars:

'Inspire, care, develop, thank and appreciate'. With this understanding, we encourage our employees to be inspired by each other and inspire each other, care about their own development, and live a balanced, happy life. In the upcoming period, we will continue to support and improve our employees' competencies in line with their needs and cultural differences."

#### About Great Place to Work

Great Place to Work® is a specialized institute in the field of developing excellent workplace culture and strategic organizational culture focusing on employees. With over 25 years of experience, the Institute analyses the communication between employees and employer or executive, the relationship between employees and their work, and the communication between employees and colleagues. One of the most important tools in these analyses is the Trust Index® surveys conducted on employees of the corporate culture in terms of credibility, respect, fairness, pride and team spirit. Another tool is the Culture Audit which measures HR and management practices.

### Best Practices in Internship Program Award to Kordsa Brazil



Kordsa was ranked in first place in the industry category by the Instituto Euvaldo Lodi in terms of Best Practices in Internship Programs in the Bahia region, where it conducts its operations in Brazil. Encouraging trainees to participate in important projects, the opportunities it provided and, most importantly, an egalitarian approach to employees and trainees can be counted among the most important factors leading Kordsa to receive this award.

## Kordsa is Once More Among "Turkey's Top 50 CHRO"



Global Human Resources & IT Director of Kordsa, Nazan Keskin, is listed among Turkey's most effective "Top 50 Chief Human Resources Officer (CHRO)" by Fortune Turkey magazine and DataExpert. Within the scope of the CHRO Summit 2018 on 15 February 2018, which emphasized the importance of HR function for the rapid adaptation of the business environment to digital era, the HR Managers who manages human resources in the most effective way and who implements unique applications in human resources, are also recognized and appreciated.

As a result of Kordsa's deep commitment and effective strategies to reinforce its human resources, Nazan Keskin, Director of Global Human Resources and Information Technologies, was deemed worthy of being among the top 50 MOST CHROs. Kordsa has received many other global awards in 2017 in this regard, thanks to its effective human resources management in every geography it operates.

## Export Champions Award to Kordsa

For its contributions to the foreign trade in the Turkish economy, Kordsa was awarded in the textile category at the "TIM 25<sup>th</sup> Ordinary General Assembly and the 2017 Export Champion Award Ceremony" organized by the Turkey Exporters Assembly and with the participation of Prime Minister Binali Yıldırım on the June 30, 2018 Saturday held at the Istanbul Halic Congress Center. Kordsa Finance Manager Ümit Coşkun received



the award from Minister of Economy Nihat Zeybekçi and Minister of Customs and Trade Bülent Tüfenkci. With this award, Kordsa's pioneering and exemplary position in export was once again approved.

At the ceremony, the top three performing companies with the highest volume in export were awarded in approximately 90 industries including the textile category in which Kordsa received an award.

# WE REINFORCE LIFE

## CSR Projects

### Kordsa Reinforces the Future Through Reinforcing Youth

In line with its vision to encourage young people to engage in technology, innovation, R&D and engineering, Kordsa has been recently included in the R&D Staff Training Program for the Textile Industry which is carried out by Uludag University Career Application and Research Center. Within the scope of this training program, Kordsa started to give training to the students. The first training was held at the Kordsa Izmit facility on February including a training session on project management and special fiber production technologies, and a visit to the production lines of Izmit facility. The second training on composite technologies was on March at the Composite Technologies Center of Excellence. Approximately 25 students took part in the program, nearly all of the students are studying textile engineering.

The Ministry of Science, Industry and Technology supported this program which is one of the projects that Kordsa, exporting technology to the whole world from Turkey, promoted with its mission to reinforce the future.



### Kordsa Reinforcers Runs at Runatolia



Kordsa Reinforcers participated in the 13<sup>th</sup> International Antalya Marathon for the third time. Kordsa, continuing its corporate social responsibility initiatives in an effort to reinforce the future, ran for Make a Wish Foundation, an organization that strives to grant the wish of every child diagnosed with a critical illness. Kordsa reinforcement professionals have been participating Runatolia marathon since 2015 for different charities each year, and those who ran this year, raised money to make the dreams of 3 children come true. Make a Wish Foundation is the world's largest wish-granting organization that is active in more than 50 countries on five continents through its 41 affiliates to bring life changing experiences to the lives of kids with life threatening medical conditions.

### Kordsa Continue to Reinforce Children's Future

Kordsa cooperated with Kocaeli Reading Art Book Club (Okuma Sanatı) by putting book collection bins to 11 different locations in Izmit plant and Composite Technologies Center of Excellence, thus contributed to the donation of books and reinforced the future of the future of the youth.



## Reinforcers in Indonesia Held Sports and Arts Week



The Sports and Arts Week (PORSENI) is an event held in Indo Kordsa every year with the aim of encouraging the employees to do sports and attend arts. In addition to the sports competitions which have been organized all week long, a painting contest themed “water and electricity saving” has been organized among little Reinforcers.

## Kordsa Provided Training at Yıldız Technical University

Kordsa, supporting university projects with the mission of reinforcing the future, provided training on composite sector and areas of usage at Yıldız Technical University. Sharing details of composite technologies with university students, the composite technologies business unit of Kordsa then informed the students about the Composite Technologies Center of Excellence, an open innovation hub, which is the first and only example of the university and industry collaboration in Turkey.



## Indo Kordsa Aid Campaign



Kordsa Reinforcers visited the villages in the vicinity of Bogor region where the Indonesian factory of Kordsa was located and distributed donation boxes to people in need. Kordsa will continue to reinforce societies of all regions in which it operates.

## Kordsa Came Together with Little Reinforcers

Kordsa visited the school in the Bahia region within the scope of the Excellence Visit made to the factory in Brazil. Organizing a variety of games and activities with the little students of the school it supported within the scope of social responsibility project at the end of the day, Kordsa will continue to reinforce the future with its social responsibility projects.



## Indo Kordsa has Started The School Restoration Project



Kordsa has initiated a restoration project for a school in the Bogor region, where it carries on its operations in Indonesia. Kordsa, laying the foundations for restoration works within the scope of the project, will continue to reinforce the future with its social responsibility activities.

## Kordsa Reinforcers Participated in the “Read across America” Project

Kordsa reinforcers participated in the “Read across America” awareness project initiated by the U.S. National Institute of Education to motivate children to read. Reinforcers held reading sessions in four different classrooms at their sister school, Dupont Elementary School.



## Kordsa Reinforcers Attended the Community Night Event in the United States



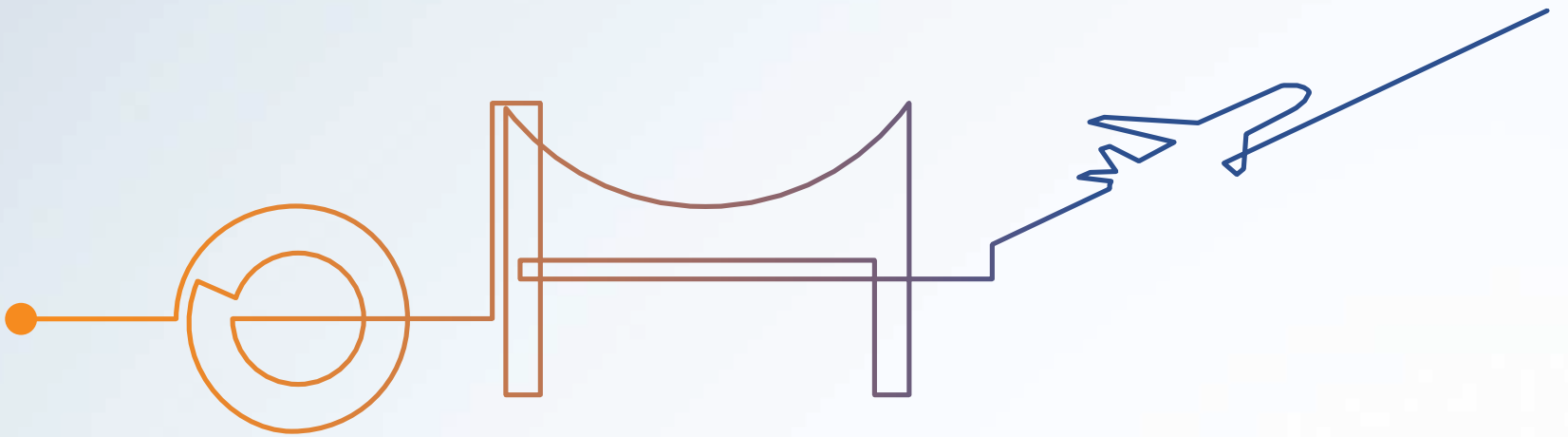
Kordsa Reinforcers attended the Community Night event organized by their adopted school, Dupont Elementary School. Reinforcers served food and drink to students and their parents and had fun together.

## Kordsa Continue to Reinforce Children’s Future

Kordsa provided training on the composite sector and its areas of usage during Sabancı University Summer School. Sharing details of composite technologies with high school students, the composite technologies business unit of Kordsa then informed the students about the Composite Technologies Center of Excellence, an open innovation hub, which is the first and only example of the university - industry collaboration in Turkey.



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