INTESA SANPAOLO
INNOVATION CENTER

INDUSTRY TRENDS REPORT
AGRICULTURE, FOOD & BEVERAGE

August 2021

FROST & SULLIVAN

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EXECUTIVE SUMMARY

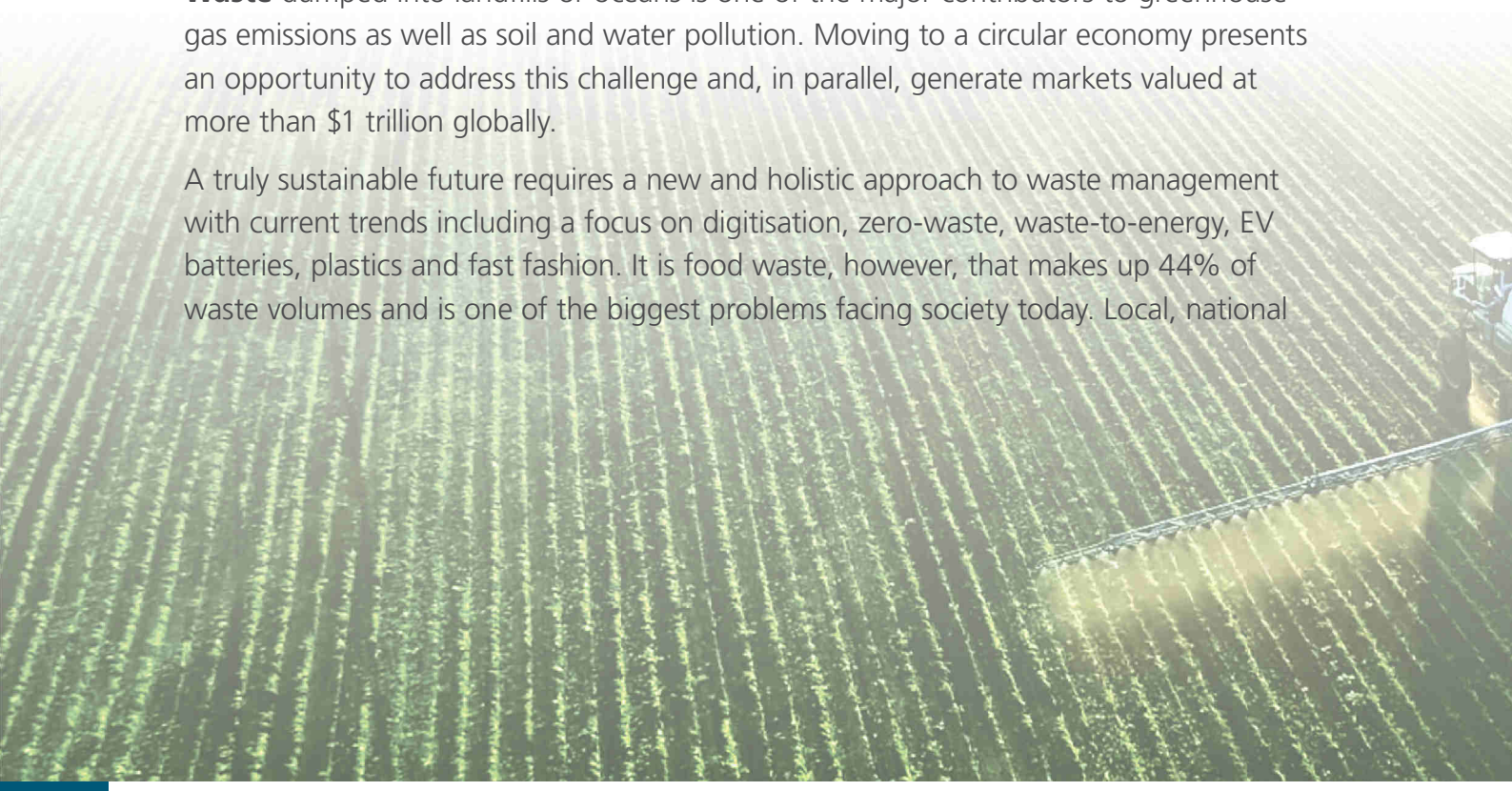
Over the course of the 2020, COVID-19 moved from being "just" a health crisis to a health and economic crisis. In the Food and Beverage industry, consumer behaviour, sales channels and supply chains were affected equally with the pandemic sharpening the industry's (and regulators') minds on the ways in which we **package** food and dispose of **waste**. The renewed focus on key issues such as sustainability, safety and security also extended across the Food and Beverage market encompassing **agricultural practices** at one extreme and packaged and **processed foods** at the other.

Food **packaging** has grown from conventional materials such as glass and metal to include technologically advanced flexible and rigid solutions. Globally, the market was valued at $115.9b in 2019 and is developing at 1.2% with players across the board wrestling with the related requirements of reducing weight, increasing durability and – as a result of COVID-19 – serving e-retailers.

Here, as in the other industries, environmental concerns are prompting a search for sustainable alternatives to single-use plastic packaging in particular. A return to glass and metals might provide a partial solution but bioplastics are thought to be the most viable short- to mid-term option. Bio-based plastics are derived either fully or partially from organic polymers which stem from starch, fibres, plants and animal proteins and are attracting the attention of researchers, start-ups and major chemical companies all of which recognise that they have the potential to provide ecological packaging solutions.

Waste dumped into landfills or oceans is one of the major contributors to greenhouse gas emissions as well as soil and water pollution. Moving to a circular economy presents an opportunity to address this challenge and, in parallel, generate markets valued at more than $1 trillion globally.

A truly sustainable future requires a new and holistic approach to waste management with current trends including a focus on digitisation, zero-waste, waste-to-energy, EV batteries, plastics and fast fashion. It is food waste, however, that makes up 44% of waste volumes and is one of the biggest problems facing society today. Local, national



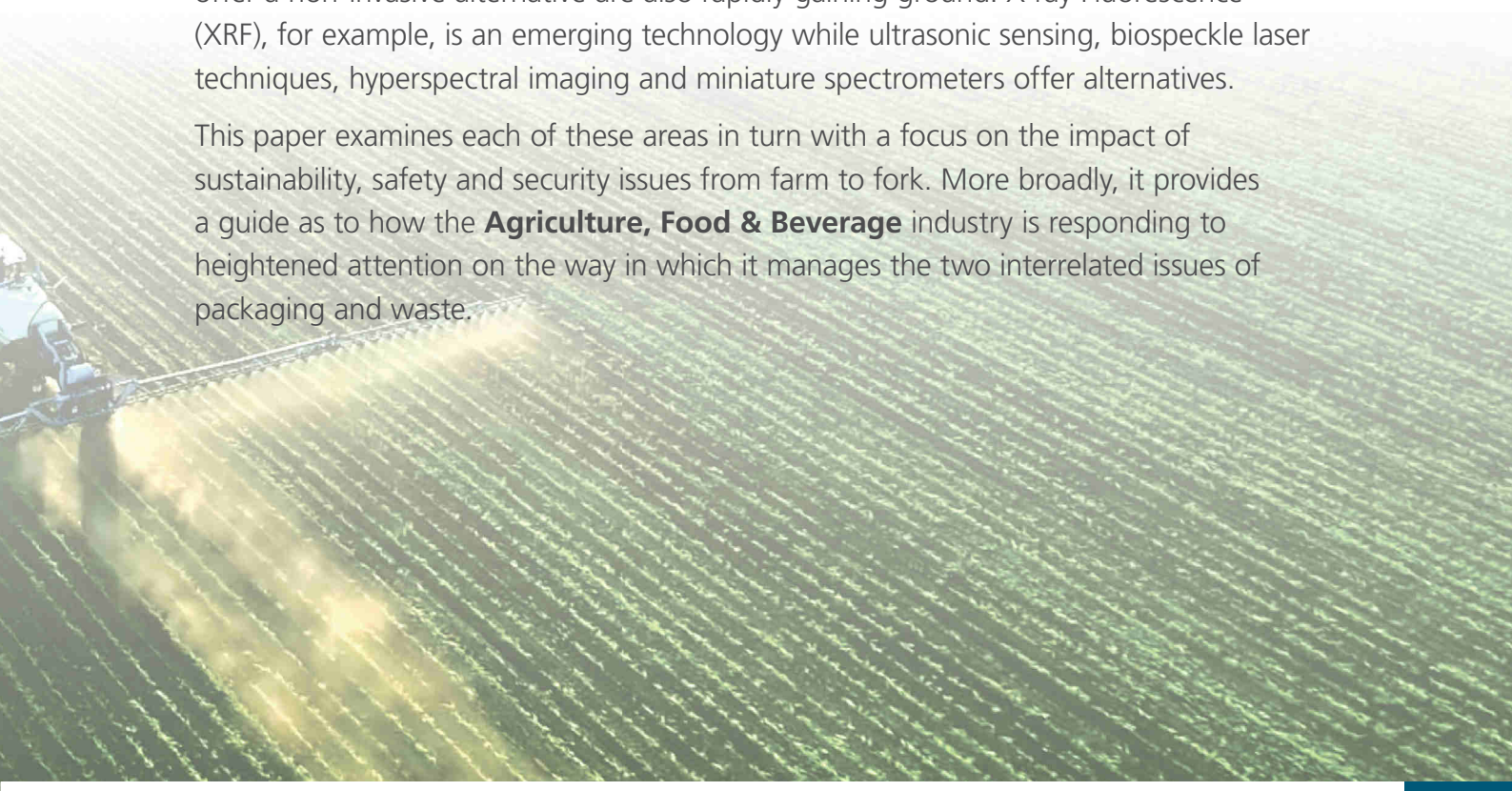
and international authorities are responding with a range of strategies while many companies are in turn looking to develop ways of harnessing food and farm residues to develop valuable products such as building materials, bioplastics, textile fibres and biofertilisers.

Indeed, the crop chemicals market is another space that is being shaped by concerns over the environment. The European pesticides and fertilisers sector remains dominated by synthetic solutions but regulatory support and increasing consumer awareness of the benefits of organic farming are driving the emergence of green **agricultural practices**. Bioherbicides are eco-friendly weed management solutions which stem from plants or microbes and are available in dry, liquid and paste form while biofertilisers draw on amino acids, seaweed and plant extracts to stimulate and support crop growth.

Overall, the global packaged and **processed food** and beverage market was valued at $3,500 billion and is expected to grow by at least 2.5% in 2021 to $3,587 billion. Here too, it is end-users that are increasingly looking for sustainable goods with the expectation of full visibility and transparency an expression of the continued focus on quality. Frost & Sullivan's finds that much of the innovation in respect of security in the sector is currently focused on detecting pathogens and toxins and checking freshness and ripeness using tests such as DNA assays.

In addition to chemical methods, new "physical" food inspection techniques which offer a non-invasive alternative are also rapidly gaining ground. X-ray Fluorescence (XRF), for example, is an emerging technology while ultrasonic sensing, biospeckle laser techniques, hyperspectral imaging and miniature spectrometers offer alternatives.

This paper examines each of these areas in turn with a focus on the impact of sustainability, safety and security issues from farm to fork. More broadly, it provides a guide as to how the **Agriculture, Food & Beverage** industry is responding to heightened attention on the way in which it manages the two interrelated issues of packaging and waste.



AI	*Artificial Intelligence*
B	*Billion*
C&D	*Construction & Demolition*
CAGR	*Compound Average Growth Rate*
CFU	*Colony-Forming Unit*
CO2	*Carbon Dioxide*
DNA	*Deoxyribonucleic Acid*
EAS	*Electronic Article Surveillance*
EBIC	*European Biostimulants Industry Council*
ED-XRF	*Energy Dispersive X-ray Fluorescence*
EG	*Ethylene Glycol*
EV	*Electric Vehicle*
F&B	*Food & Beverage*
FDA	*Food and Drug Administration*
FDCA	*Furandicarboxylic Acid*
FSC	*Forest Stewardship Council*
G	*Gram*
GM	*Genetically Modified*
GMO	*Genetically Modified Organism*
HDPE	*High-Density Polyethylene*
HORECA	*Hotel/Restaurant/Catering*
HRP	*Horseradish Peroxidase*
IWM	*Integrated Weed Management*
M	*Million*
ML	*Machine Learning*
MM	*Millimetre*
MOA	*Mode Of Action*
MSW	*Municipal Solid Waste*
NFC	*Near Field Communication*
NIR	*Near-Infrared*
PCL	*Polycaprolactone*
PET	*Polyethylene Terephthalate*
PHA	*Polyhydroxyalkanoate*
PHB	*Polyhydroxybutyrate*
PLA	*Polylactic Acid*
PP	*Polypropylene*
PSA	*Pressure-Sensitive Adhesives*
PVOH	*Polyvinyl Alcohol*
QR	*Quick Response*
R&D	*Reseach & Development*
RFID	*Radio Frequency Identification*
RNA	*Ribonucleic Acid*
ROI	*Return On Investment*
RRNA	*Ribosomal Ribonucleic Acid*
SDG	*Sustainable Development Goal*
SERS	*Surface Enhanced Raman Spectroscopy*
T	*Trillion*
TXRF	*Total Reflection X-ray Fluorescence*
UK	*United Kingdom*
US	*United States*
WEEE	*Waste Electrical and Electronic Equipment*
XRF	*X-ray Fluorescence*

ABOUT INTESA SANPAOLO INNOVATION CENTER:

Intesa Sanpaolo Innovation Center is the company of Intesa Sanpaolo Group dedicated to innovation: it explores and learns new business and research models and acts as a stimulus and engine for the new economy in Italy. The company invests in applied research projects and high potential start-ups, to foster the competitiveness of the Group and its customers and accelerate the development of the circular economy in Italy.

Based in the Turin skyscraper designed by Renzo Piano, with its national and international network of hubs and laboratories, the Innovation Center is an enabler of relations with other stakeholders of the innovation ecosystem - such as tech companies, start-ups, incubators, research centres and universities - and a promoter of new forms of entrepreneurship in accessing venture capital. Intesa Sanpaolo Innovation Center focuses mainly on circular economy, development of the most promising start-ups, venture capital investments of the management company Neva SGR and applied research

For further detail on Intesa Sanpaolo Innovation Center products and services, please contact businessdevelopment@intesasanpaoloinnovationcenter.com

ABOUT FROST & SULLIVAN:

For over five decades, Frost & Sullivan has become world-renowned for its role in helping investors, corporate leaders and governments navigate economic changes and identify disruptive technologies, Mega Trends, new business models and companies to action, resulting in a continuous flow of growth opportunities to drive future success.

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