9

Transformative Marketing Using Drones

Overview

Drones have been receiving increasing attention among companies, largely due to their varied applications in real-world uses. Formally known as unmanned aerial vehicles (UAVs), enterprise drones (i.e., drones used by commercial enterprises in their regular operations) have captivated businesses and users alike for their multipurpose civilian uses. However, drones were first developed for use in specialized military operations. Since their initial development, the commercial applications of drones have been muted, until recently.[1]

From a business standpoint, the developer community continues to serve as a major source of growth drivers by developing various commercial uses and applications for drones. Some of the popular uses of drones currently include asset tracking and management, preventive maintenance, environmental management, security and surveillance, media, and photography, and so on. Further, drones have emerged as a valuable NAT in several industries such as agriculture, construction, transportation and warehousing, mining, insurance, and civil services such as law and order, emergency operations, and disaster management, in addition to becoming a popular hobby.[2]

Further, many companies have expressed optimism about the growth and adoption of drones in the coming years. On the consumer side, nearly 65% of Americans expect that in the next 20 years, most deliveries in major cities will be made by robots or drones rather than humans.[3] As seen in the case of other NATs, drone applications are also expected to increase even further as they develop advanced capabilities, receive regulatory

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support, enjoy consumer acceptance, and witness advancements in public infrastructure.[4] In this regard, the marketing applications of drones appear to be particularly appealing as businesses strive to demonstrate and deliver value-enriching offerings.

This chapter is organized as follows: A brief history of the origin of drones is presented, followed by a definition of drones (from a marketing standpoint). Then, a discussion on the various classifications of drones is presented spanning military, consumer, and business applications, with a special focus on disaster response applications. Next, marketing applications of drones focusing on understanding customer needs, revisiting firm capabilities to integrate drones, designing drone-focused marketing mix strategies, driving customer engagement (CE) through drones, and designing digital strategies with drones are discussed. Finally, the future of drones for the marketing industry is discussed through specific business and customer-facing tasks such as businesses' enhanced ability to establish CE, and ways of advancing customer contact solutions.

Origin, Definition, and Classification of Drones

Origin

The UAVs have their origins in military actions with the earliest instance being unmanned balloons loaded with explosives used when Austria attacked Venice in 1849. While these balloons did not involve technology, the first technological creation of UAVs occurred in 1916 during World War I. The United States developed the Kettering Bug, an aerial torpedo that was capable of striking ground targets. However, the war ended before the Bug could be deployed. Subsequent advancements of the Bug led to the development of the first remote-controlled aircraft called the Radioplane OQ-2 in 1941.[5]

Drones borrow their name from the male bees that have limited and focused use in the bee community—i.e., to mate with a fertile queen bee. They were first introduced to the public as remotely controlled aircraft for a battleship weapon's target practice. Examples of such drones include the Fairy Queen and the De Havilland Queen Bee seaplane introduced during World War I.[6] The following decades witnessed the development of drones for various military purposes such as battlefield operations, surveillance and reconnaissance, communications, delivery, and relief measures, among others. More recent sophistication in drones relates to capabilities on performance, flying at higher altitudes, better fuel efficiency, covering longer

distances, solar-based models, and so on. Now, drones are not restricted only for military purposes but are being successfully used in commercial applications such as environmental assessment, goods transportation, security, media and photography, agriculture, rescue operations, and many more.

Definition

While the concept of a drone may seem straightforward, the definition of a drone is far from it. The definition of a drone varies based on terminologies used, applications/markets served, and physical/technical characteristics. A drone can, therefore, be "defined" based on these three aspects. The following discussion provides a brief overview of these three aspects that can be illustrative in demonstrating the difficulty in identifying a widely accepted definition of drones.

Regarding the terminologies used, several terms such as unmanned aerial vehicle (UAV), unmanned aircraft system (UAS), remotely piloted vehicle (RPV), remotely piloted aircraft (RPA), remotely piloted aircraft systems (RPAS), and drones have appeared in the literature. Table 9.1 explains these terms. While all these terms refer to the basic concept of driverless flight onboard, the level of overlap between these terms indicates the complex nature of drones. Going forward, in this chapter, we will use the term "drone" to refer to unmanned aircraft that fly as per human-assisted commands and are capable of flying autonomously.

Regarding the applications/markets served, drones continue to be used in a wide range of settings. The Association for Unmanned Vehicle Systems International (AUVSI) identifies the following five markets for drones—academic market (i.e., for scientific research purposes), civil market (i.e., for government non-military purposes such as the first responders), commercial market (i.e., uses developed by for-profit businesses), consumer market (i.e., for individual consumers and hobbyists), and military market (i.e., for military purposes).[14,15]

Classification of Drones

Drones are also understood based on their physical/technical characteristics. Drone characteristics such as wing systems, autonomy, size, energy source, payload, and sensors have been identified as particularly prominent in understanding and classifying drones.[16] These drone characteristics are discussed briefly here.

Table 9.1 Similar terms relating to drones

Term	General description	Reference
Unmanned aerial vehicle (UAV)	Aerial vehicles that provide wireless connectivity by transmitting data remotely, and typically without an onboard pilot	Zeng et al.[7]
Unmanned aircraft system (UAS)	An aerial system is made up of many sub-systems that include the aircraft, its payloads, and the control station(s). Essentially, it's an aircraft with its crew removed and replaced by a computer system and a radio link	Austin[8]; Watts et al.[9]
Remotely piloted vehicle (RPV)	Class of UAVs designed to have some degree of interaction with a human controller via a data link but may possess autonomous flight control capability	Larm[10]
Remotely piloted aircraft (RPA)	A sub-category of an unmanned aircraft where the flying pilot is not on board the aircraft	ICAO[11]
Remotely piloted aircraft systems (RPAS)	A set of configurable elements consisting of an RPA, its associated remote pilot station(s), the required command and control links, and any other system elements as may be required, at any point during flight operation	ICAO[12]
Drone	An unmanned aircraft that can fly autonomously	Villasenor[13]

Wing systems. This relates to the wing system of the drone. Three broad types of wing systems have been identified.

- *Fixed-Wing Systems*. Refers to fixed, static wings in combination with forward airspeed to generate lift. Therefore, these drones are built to cover long distances. Such drones can be seen in military operations and delivering relief measures (see Image 9.1).
- *Multirotor Drones*. Such drones are equipped with multiple small rotors, at least four. Known for their ability to hover in the air, be noiseless, and be lightweight, these drones are ideally suited for aerial photography and carrying small loads. However, they can remain airborne only for a short duration (see Image 9.2).
- *Hybrid Systems*. Possess characteristics of fixed-wing systems and multi-rotor drones. Ongoing research on these drones has developed models that can stay airborne for a longer duration, be powered by batteries and electric motors, and fly longer without having to refuel. Such drones can be useful in conducting research and performing search and rescue operations, especially in hazardous conditions.

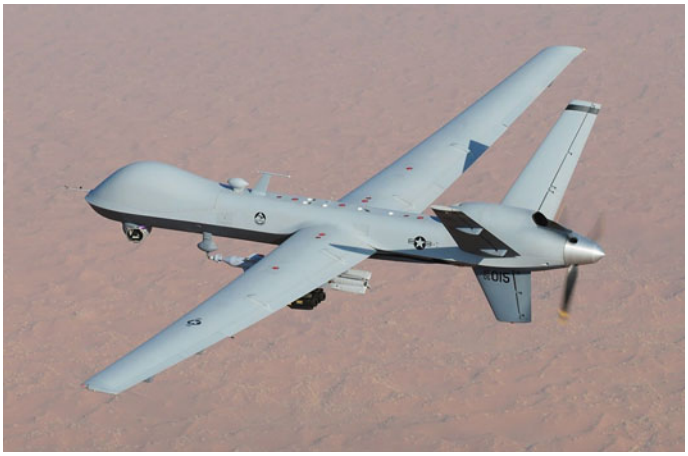

Image 9.1 Fixed-wing drone
(*Source* Image by *US Air Force Photo / Lt. Col. Leslie Pratt*)

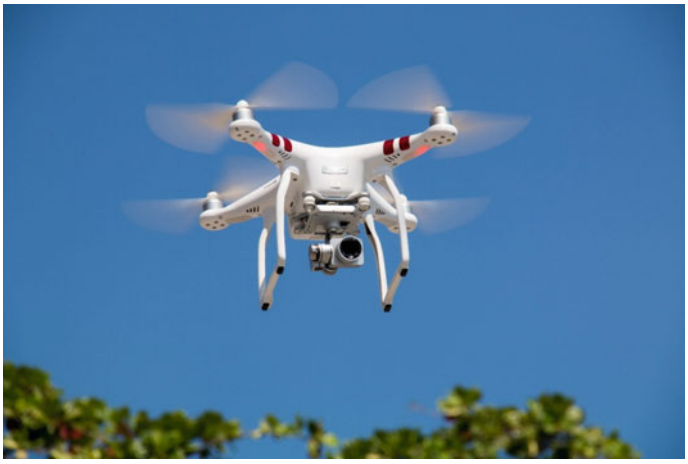

Image 9.2 Multirotor drone
(*Source* Image by *Inmortal Producciones* from *StockSnap*)

Autonomy. Drones have some degree of autonomy, owing to the absence of an in-flight operator. Here, the distinction between autonomous systems and automatic systems provided by the US Department of Defense (US DoD) is critical.[17]

- *Automatic Systems*. Fully preprogrammed systems that act repeatedly and independently of an external influence or control. While automatic systems can be self-steering or self-regulating and can follow an externally given

path while compensating for small deviations caused by external disturbances; they are unable to define the path according to some given goal or to choose the goal dictating its path.

- *Autonomous Systems*. Self-directed systems perform towards a goal in that they do not require outside control, but rather are governed by laws and strategies that direct their behavior. In this sense, an autonomous system is self-directed by choosing the behavior it follows to reach a human-directed goal. Most notably, they cannot exercise a "freedom of choice".
- The US DoD identifies the following four levels of autonomy—(a) *human-operated* (a human operator makes all decisions), (b) *human-delegated* (the vehicle can perform many functions independently of human control when delegated to do so), (c) *human supervised* (the system can perform a wide variety of activities when given top-level permissions or direction by a human), and (d) *fully autonomous* (the system receives goals from humans and translates them into tasks to be performed without human interaction)

Size. The size of drones is a key character to understand and classify drones. Clarke[18] contends the size of drones is the most important factor in recognizing the distinct categories of drones, and classifies drones as (a) large drones (100 kg–150 kg), (b) mini-drones (20–30 kg), (c) micro-drones (0.1kg–7 kg), and (d) nano-drones ("smart dust" or "smart particles"). As a result of the varying sizes, these drones would likely serve different markets and applications. For instance, while large drones could be used in commercial applications such as transportation and rescue operations; micro-drones could be used in applications such as reconnaissance and environmental monitoring.

Energy Source. Drones are typically powered by one of the following energy sources such as (a) traditional airplane fuel (e.g., kerosene) that is primarily used in fixed-wing drones, (b) battery cells (e.g., rechargeable battery cells) that are used in multirotor drones, (c) fuel cells meant for use in fixed-wing drones, and (d) solar cells meant for use in fixed-wing drones.

Payload. This refers to the weight a drone can carry. While it does not include the weight of the drone itself, it does include anything placed or fitted in the drone such as sensors, task-related equipment (e.g., camera, weapon, etc.), and items for delivery/transportation. Therefore, smaller-sized drones typically used for hobby purposes are expected to have a lower payload (less than 2 kg (i.e., 4.4 lbs)), while drones used for military or professional purposes are expected to have a higher payload (even up to 200 kg). Further, the payload handling range is jointly determined by the flying time and flying range of the drone. Therefore, while hobby drones are designed to maximize

flight time and flight range, the payload capacity is often not too high. Similarly, for drones involved in rescue and relief missions, payload capacity could be prioritized over flight time and flight range.

Sensors. Sensors are an important category of payload included in drones. Examples of sensors include cameras, microphones, and scientific sensors used for various purposes such as testing, measurement, security, and many more. Drones being developed now often include cameras and microphones. The popular audio/video uses of sensors include security monitoring, surveillance, access control, intelligence gathering, cartography, geo-mapping, land surveys, archeological surveys, wildlife photography, and media and entertainment, among others. The popular types of scientific sensors include biological/chemical/meteorological sensors for various measurement and testing purposes, sensors for testing environmental emissions, surveying landfills, estimating environmental degradation and pollution, scientific studies involving data collection, agricultural crop spraying, and monitoring, combating natural disasters, assessing the impact of natural disasters, estimating populations, conducting atmospheric studies, and wildlife conservation and management, among others.

As seen from the above discussion and Table 9.1, the closeness of the related concepts involving drones indicates the evolving nature of this technology, and therefore the absence of a precise definition. Broadly, drones have been referred to as any type of vehicle, including aircraft, characterized by the absence of an onboard pilot and either autonomous or piloted from the ground.[19] It is important to note that many military forces do not prefer the term "drone", instead preferring the use of terms such as UAV (e.g., in the United States and Australia) and RPA (e.g., in Europe and Australia).[20] However, the popular usage of the term drones now refers to any unmanned aircraft that is flown by an operator on the ground or is capable of fully autonomous flight with no direct human intervention.[21]

Overall, whereas drones present important strategic implications to governments and militaries worldwide, they represent a fast-growing area that is of keen interest to corporations and application developers. The ever-expanding capabilities of drones provide corporations with more access to users, more opportunities for customer interaction touchpoints, more avenues for operational efficiencies, and richer sources of information, among others. In this regard, Kumar and Ramachandran[22] propose that drones qualify as a function-oriented technology that can allow companies to develop capabilities to gain increased accessibility to areas and situations that humans cannot access safely. Additionally, the firm can achieve increased efficiency

and accuracy in tasks requiring precision and attention to detail, in addition to consistently obtaining positive results.[23] To conclude the overview of drones, the following vignettes present the possibilities of drones and how companies and users are deriving value from such offerings.

Military-Oriented Technology

Drone applications are perhaps the most visible in military operations.[24] In addition to birthing this technology, the military remains the most advanced user of this technology that hinges on significant goals and outcomes. Specifically, the ability to make offensive strikes on adversaries away from immediate danger presents critical strategic advantages to the user. Further, the operational efficiencies provided by drone usage have not only prevented loss of lives but also continued to aid in vital military rescue missions, thereby significantly impacting countries' foreign policies.[25] The vitality of drones in the military can be seen in the development of drone electronics (i.e., the sensors).[26] In this regard, world military organizations (e.g., the UK Ministry of Defence) have also recognized the importance of civilian drone popularity and commercial expertise in advancing drone technology that can help the military in significantly driving drone adoption and use.[27]

While the validity of drones in a military setting is increasingly justified by their continued usage around the world, the critical strengths, and weaknesses of drones from tactical and strategic perspectives warrant attention. Specifically, drones strengthen militaries from various aspects such as (a) doing the dull, dirty, and dangerous work deemed for humans, (b) ensuring vital presence where manned forces are not feasible, (c) are economical to use and operate, (d) safeguarding human military personnel, (e) facilitating limited physical presence in dangerous territories, (f) securing more intelligence to gain a good understanding of the local situation, especially in hostile areas, (g) allowing to be used clandestinely, (h) effectively countering time-sensitive targets, and (i) augmenting military capabilities through ongoing technological improvements (e.g., satellite capabilities, advanced sensors, etc.).

In contrast, drones also present critical weaknesses for the military such as (a) exposure to information and communications hacking, (b) performance subjective to inclement weather (e.g., snow, wind, etc.), especially in lower-end drone models, (c) lower drone speeds could increase risk exposure, (d) high development costs, especially in updating with advanced drone electronics, (e) inability to distinguish between friendly and hostile human populations, (f) lesser than ideal load carrying capacities, especially weaponry,

(g) easy availability to adversaries, (h) challenges in securing radio frequency spectrum, and (i) lack of clarity in proportion and suitability of manned vs. unmanned drone operations.

In addition to combat-related functions, drones also render vital support in non-combat military projects.[28] Such projects are often in the areas of nation-building, peacekeeping missions, infrastructure support, and sensitive civilian-focused projects. Military organizations around the world use drones for vital functions such as mapping, identifying geohazards, construction, and maintenance of critical country infrastructure (e.g., highways, bridges, military bases, etc.), assistance in civil engineering projects (e.g., dams, refineries, energy projects, etc.).[29] Further, through its research and development initiatives, the military often develops applications using NATs that subsequently became available for civilian use.[30] Popular historical examples include the development of duct tape, the microwave oven, GPS, the Internet, and virtual reality which were first created by the US military for their internal operations.[31] Therefore, drones are a fast-emerging technology that continues to power the military in war and non-war projects.

Consumer Applications

Consumer use of drones has increased due to the inclusion of exciting drone features.[32] While military drones are equipped with highly functional and essential features that are used in strategic and tactical operations, consumer drones focus on hobbyists expecting fun and recreation-related features. In the United States, the Federal Aviation Administration (FAA) considers recreational or hobby UAS or drones as those used for enjoyment and not for work, business purposes, or compensation or hire. The FAA deems such aircraft as "model aircrafts" and defines them as "an unmanned aircraft that is (1) capable of sustained flight in the atmosphere; (2) flown within visual line of sight of the person operating the aircraft; and (3) flown for hobby or recreational purposes".[33] In this regard, popular consumer drone applications largely focus on recreation aspects such as photography and sporting activities, among others.

Perhaps the biggest attraction of drones for personal use lies in the features of photography. While using drones for commercial photography may be classified as a business application, individuals and photography enthusiasts increasingly use drones for taking visually stunning photographs. With high-quality cameras and recording devices becoming a standard feature in newer drone models, aerial photography has become a fun and creative pastime (see Image 9.3). Further, wildlife enthusiasts also use drones to capture dramatic

images. When handled well, drone photography can be useful in educational pastimes such as bird watching, identification of flora/fauna, and independent scientific research explorations.[34] However, experts caution how using drones for capturing images of birds, for example, can be disruptive for the birds when not sensitively conducted.[35] This can especially be so in the case of beginner or amateur drone photographers. Another interesting area of aerial photography for personal use is event photography (e.g., weddings, social gatherings, graduation parties) and social media participation (e.g., photos by social media influencers, high-quality images for sharing).

Drone racing is another area of personal drone use that is making rapid progress. This sport requires the drone operator to wear a first-person view (FPV) headset device that is connected to a camera mounted on the drone. This allows only the racer to see the path of the drone, and the goal of the race is to complete the set course as quickly as possible (see Image 9.4). Such drones typically carry features such as agility to make sharp turns, lightweight, and the ability to make acrobatic turns. This sport, which originally began in

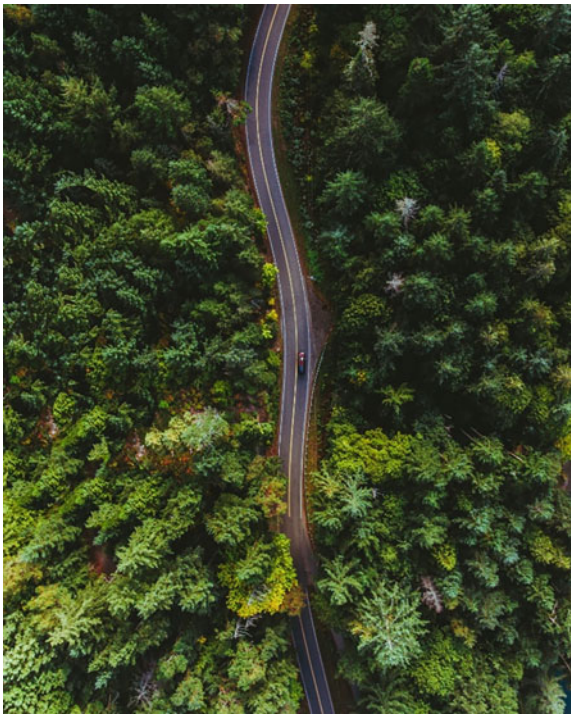

Image 9.3 Drones used in Aerial Photography (*Source* Image by *Bobby Stevenson* from *Unsplash*)

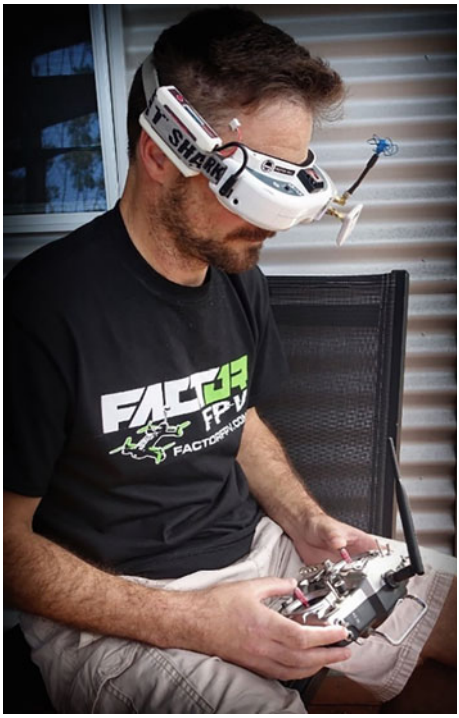

Image 9.4 Drone Racing. First-person view drone racing (*Source* Image by *Siggy Nowak* from *Pixabay*)

Australia in 2014, has now attracted worldwide participation and viewership involving several professional organizations.[36]

Business Applications

The extent and impact of drones on business applications are expanding at a vigorous pace. Advancements in various commercial operations are being developed to create more value for businesses and customers.[37] Research from the Boston Consulting Group estimates that by 2050, the industrial drone fleet in Europe and the United States will comprise more than 1 million units and generate $50 billion per year in product and service revenues,[38] and analysts at Barclays contend that the use of drones will result in cost savings of some $100bn.[39] Overall, companies are identifying opportunities to infuse more value into their offerings with the expectation of deriving more value from customers. The following uses provide a flavor of such business applications using drones:

- *Drones in Agriculture*. Many developing countries' economies are heavily dependent on agricultural produce for sustenance and exports. Despite its importance, the sector is prone to crop failure due to adverse weather conditions, uncontrolled pests, etc. In India, the farmers are dependent on monsoon rains for irrigation and implement age-old farming methods. The quality and quantity of the produce are compromised despite the efforts of the farmers. Through the integration of technological advancements in farming practices, the sector could mitigate failure and disasters. Drone-based agricultural practices are picking up momentum in India, with key roles to play in precision agriculture, improvement in crop yield, and locust control. For instance, farmers in India using drones for spraying herbicides and pesticides have realized significant time and labor savings. Instead of around three to four hours to spray over an acre, a drone can finish the work in just 10–12 minutes. This translates to significant cost savings incurred due to hiring farm labor.[40]

  The use of drone technology in agriculture aids in reducing time and increasing the efficiencies of the farmers. With infrared mapping, drones can gather information about the health of the soil and the crop—thereby ensuring crop health. They detect minute signs of pest attacks and provide accurate data about the degree and range of the attack. Since agriculture is prone to be impacted by extreme weather conditions, drones can be useful in detecting upcoming weather conditions and can prepare farmers for adversities in advance. Agri drones are sturdy, low-cost, and require minimum maintenance. However, these drones are heavily reliant on internet connectivity, weather-dependent, and require the right sets of skills and knowledge to operate them.

  In 2019 survey by the California Farm Bureau Federation (CFBF) found that 56% of participating farmers were unable to hire all the employees they needed at some point during the past five years.[41] A similar situation can be seen across the United States. For example, between 2002 and 2014, the number of field and crop workers in America fell by 146,000, and the wages of field and crop workers during this period increased by 12%.[42] The above two facts indicate that rising wages and a decline in the number of farm laborers have accentuated the challenges faced by the agriculture industry.

  In this regard, drones are viewed as a labor-saving technology with many farmers actively using drones for a range of farm-related activities.[43] Drones are used in farming activities such as crop estimation, yield assessment, irrigation leak detection and management, pest control, seeding, spraying of fertilizers/pesticides, crop/livestock health assessment, soil, and

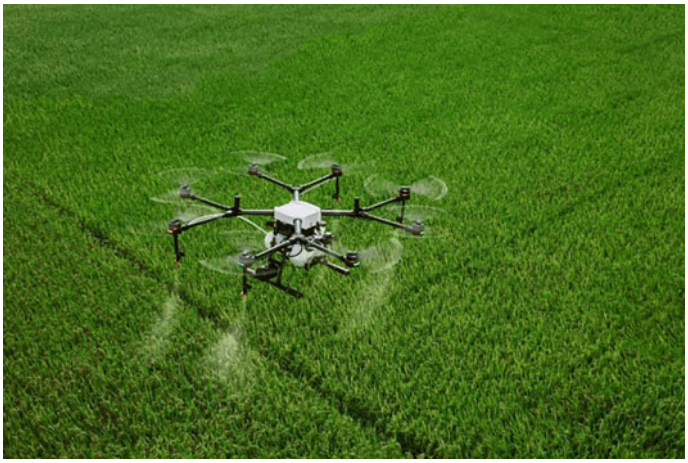

Image 9.5 Drones used in spraying farms (*Source* Image by *DJI-Agras* from *Pixabay*)

field analysis, and so on (see Image 9.5). However, the adoption has not been as widespread as expected due to operational challenges such as drone safety, privacy issues, and insurance coverage.[44]

- *Drones in Construction*. Drones have been demonstrating significant value in the construction industry, primarily with their varied applications in construction sites. Some of their key implementations include (a) aerial surveys of work sites, (b) progress tracking, (c) construction planning and management (especially at the preconstruction stage), (d) quality control, (e) work site safety, (f) risk mitigation and management, (g) work site security and surveillance, (h) stockpile management, (i) marketing communications of real estate, (j) equipment storage and installation, and so on.[45] Further drone advancements such as thermal sensors, GPS units, and high-quality cameras, in addition to augmenting drones with artificial intelligence (AI) and machine learning (ML),[46] are expected to make the drone a valued capability for the construction industry (see Image 9.6).
- *Drones in Transportation*. Drones are expected to provide critical first-mile and last-mile delivery solutions for companies and consumers. Companies such as DHL, UPS, Amazon, and Google have already started developing and testing drone deliveries and are seeing impressive results. For instance, UPS Flight Forward, a dedicated drone delivery unit, is the first organization to be certified by the US FAA to be operated as a drone airline.[47] Further Flight Forward is working with the WakeMed hospital system in North Carolina to transport medical samples to speed up diagnosis and is exploring drone delivery options for prescriptions and retail

Image 9.6 Drones used in construction
(*Source* Image by *Shane McLendon* from *Unsplash*)

products for CVS.[48] As with other industries, the ability to capture data efficiently is serving businesses well in terms of customer management. Further, when coupled with real-time communications and information-sharing capabilities, drones improve operational efficiencies and accentuate value creation.

Disaster Response

Mass disaster events always attract widespread public interest and require immediate attention from first responders and disaster management teams. While the timely mobilization of rescue and relief efforts is critical, the method of execution and operational details are vital in ensuring the success of the mission. In this regard, the Emergency Events Database (EM-DAT) containing global mass disasters that are compiled by The Center for Research on the Epidemiology of Disasters (CRED) can be used to improve decision-making for disaster preparedness.[49] While mega-disasters are not a common occurrence, it does bring to light the importance of timely and coordinated recovery/rescue efforts that can potentially minimize loss of lives and economic damages. Here, technological advancements such as drones are proving to be highly beneficial in assisting with disaster management efforts.

In the event of a major disaster, research has identified that drones can help secure better situational information for relief workers, locate and rescue survivors, perform inspection and analysis of critical infrastructure, and deliver vital supplies.[50] Further, drones can be used to install temporary communications infrastructure, generate maps of affected areas, and identify specific spots where rescue teams must prioritize efforts.[51,52]

Companies and relief organizations have also been actively using drones to coordinate relief efforts and develop better drone systems that can deliver the maximum results. This has been implemented in dealing with chemical spills, infrastructure damages (e.g., bridges, tunnels), fighting wildfires, and distributing relief items. For instance, in the fight to contain the COVID-19 pandemic, US companies such as UPS Flight Forward, DroneUp, and Workhorse Group are testing to see how drones can be used in the coronavirus response by speeding up testing and increasing social distancing.[53,54]

Drones in the Marketing 5.0 World

In the era of marketing 5.0, drones have emerged as a game changer, transforming the way businesses approach their promotional strategies. These cutting-edge aerial devices have paved the way for innovative marketing techniques that were previously unimaginable. By harnessing the power of drones, marketers can now capture data (through images and videos) and deliver personalized messages to their target audience. The versatility of drones allows marketers to showcase their products and services in a way that is both visually appealing and engaging, leaving a lasting impression on consumers.

Data-Driven Marketing Using Drones

Data-driven marketing using drones involves the use of UAVs to collect and analyze data for marketing purposes. Drones can capture various types of data, including imagery, video, and sensor-based information, to provide marketers with valuable insights. Some ways through which drones collect data that can be used for marketing campaigns include (a) delivering targeted advertisements to individuals in populated spaces (e.g., beaches, crowded parks), (b) displaying real-time data, product demos, or interactive content, engaging audiences in a dynamic and personalized way, (c) collecting user-response information (e.g., foot traffic patterns, crowd density, and even individual reactions to advertisements), and (d) gathering visual data

on competitors' activities (e.g., store layouts, promotional events, product displays).

Aerodyne, a Malaysian drone solutions company, has partnered with Amazon Web Services (AWS) to use its DRONOS software to help drone operators around the world.[55] DRONOS is a cutting-edge platform that provides a broad variety of drone services, allowing users to quickly manage and analyze drone data to improve operations, increase productivity, and conduct aerial inspections while protecting the safety of ground workers.

Aerodyne's expertise has found a significant application in agriculture, where it helps to address global food security issues by using precision farming techniques using drones. The company has successfully developed solutions such as the Agrimor platform, which is powered by DRONOS and enables farmers and agriculture service providers to use drones for various tasks including planting, spraying, plant analysis, and mapping. This platform has been developed in collaboration with AWS and has resulted in a significant increase in crop yields, with some cases reporting up to a 67% rise. Independent farmers and large palm oil plantation corporations in Malaysia and Indonesia have adopted the Agrimor platform, using it to quickly identify crop issues such as under-irrigation or disease and then deploy fertilizers or pesticides more effectively. This not only optimizes resource allocation but also contributes to the overall food security and profitability of farmland.

Predictive Marketing Using Drones

Predictive marketing using drones involves leveraging data collected by drones to make informed predictions about consumer behavior, market trends, and other factors that can influence marketing strategies. This is an exciting new frontier, offering businesses unprecedented opportunities to reach the right audience at the right time with the right message. Drones equipped with sensors and cameras can gather a wealth of information, including demographics, location, behavior, and environmental data, among others, that can be used to predict individual behaviors and interests and suggest appropriate marketing actions.

For instance, Sustainable Skylines, an American drone aerial advertising company, has obtained official approval from the Federal Aviation Administration (FAA) to operate in Miami Beach.[56] This achievement signifies a significant milestone as it is the first time a drone banner-towing operation has been granted FAA approval for commercial purposes in the United States. Unlike conventional crewed aircraft, these drones have the advantage of vertical takeoff and landing, eliminating the need for a runway or airport

and reducing fuel consumption. Once in the air, the company plans to utilize camera footage from the drones as well as third-party mobile data to evaluate the effectiveness of their advertising campaigns. By employing predictive analytics, Sustainable Skylines aims to offer dynamic pricing, adjusting their rates based on the anticipated visibility of the aerial ads. This pricing strategy mirrors the approach taken by Facebook and Google ads, which rely on actual data to support their pricing decisions.

Contextual Marketing Using Drones

Contextual marketing using drones involves decision-making, structuring activities, and delivering content based on the specific context or environment of a user. In addition to several business and marketing uses, drones can be used for coordinating emergency response and public safety messaging. In the case of emergencies or public safety announcements, drones can be deployed to deliver important messages to specific areas, ensuring that relevant information reaches the right audience promptly.

For instance, Belgium-based Citymesh is revolutionizing emergency response with its latest innovation, SENSE.[57] This groundbreaking system consists of a network of 70 Safety Drones that are strategically deployed to support police and fire services. What sets SENSE apart is its use of Drone-in-a-Box (DiaB) solutions, which are automated docking stations for drones. Within just 15 minutes of an emergency call, these DiaB stations are deployed, providing essential support to emergency centers. Not only do they serve as hubs for drone deployment, recharging, and data transmission, but they also house the drones when not in use. Designed specifically for combating fires, these drones capture high-definition 4K and thermal images, enhanced with AI technology. This valuable information greatly enhances the speed and effectiveness of emergency interventions.

To ensure comprehensive coverage, SENSE will be deployed across all 35 emergency zones in Belgium. Each zone will have two DiaB units, resulting in a total of 70 Safety Drones. This extensive network of drones aims to create a drone grid that enables emergency services to respond in a more targeted and efficient manner. Remote Operations Centres (ROCs) play a crucial role in this system, as they are equipped with skilled pilots who are available 24/7 to conduct flights and coordinate the activities of the drones. Additionally, a UTM platform ensures the safety of the flights and logs all activity. UTM, or Urchin Tracking Module, is a code that generates Google Analytics data for digital campaigns. In the context of SENSE, UTM helps track the progress

of the drones' activities on various online platforms, further enhancing their effectiveness.

The capabilities of the Safety Drones are truly impressive. They capture live HD video feeds and high-resolution images, which are transmitted in real-time to ROCs, police forces, fire brigades, and other emergency services. This real-time information allows these entities to anticipate risks and select the most suitable equipment for successful rescue missions. Moreover, the remote operators of the drones can fulfill specific requests from dispatch and local first-response teams. By focusing the drone's cameras on specific areas of interest, they provide valuable insights and support to on-ground personnel. To ensure flight safety and coordination with other aircraft, the drone operators work closely with air traffic services. This collaborative approach guarantees the safe and efficient operation of the Safety Drones in emergencies.

Augmented Marketing Using Drones

Augmented marketing using drones involves combining drone technology with existing technologies and practices to enhance marketing experiences. Additionally, the fusion of drones with related new-age technologies creates interactive and immersive campaigns that can engage consumers in novel ways. Drones can capture 360-degree views of products or environments that can be used to enhance existing capabilities and functionalities by providing additional information, features, or interactive elements. This is particularly useful for showcasing real estate, travel destinations, or complex products. Increasingly, drones are also used in niche work environments such as equipment maintenance and defense purposes.

For instance, Boeing is currently assessing how routine maintenance on its aircraft can be expedited and improved through the assistance of drones. The company has introduced the Autonomous Aircraft Inspection (AAI) program, which utilizes drones to aid in maintenance tasks and has presented its potential benefits to the US Air Force.[58] With the AAI program, an airman selects the specific area of the aircraft that requires inspection, and the drone captures photographs that are then transmitted back to the airman on the ground. These images, obtained by Air Force-owned drones, are stored in a cloud-based environment, and analyzed, allowing for data accessibility from any location. This proves advantageous in the event of identifying a defect, as technicians in different locations can collaborate and devise a plan to address the issue.

While Boeing acknowledges that the AAI program is not flawless, it asserts that it has demonstrated greater accuracy compared to relying solely on human operators, with an estimated precision level of approximately 78%. Additionally, the utilization of drones significantly reduces the time required for inspections, reducing pre-flight checks from four hours to a mere 30 minutes. The company emphasizes that the technician ultimately determines which data is stored in the cloud, highlighting that the system is not intended to entirely replace human operators. Rather, Boeing aims to enhance the expertise of human inspectors, ensuring that they possess the necessary knowledge when commencing a maintenance task, rather than relying on guesswork. By implementing this system, maintenance workers are expected to speed up getting the aircraft out of the hangar, back to the crews, and swiftly back into operation.

Agile Marketing Using Drones

Agile marketing using drones involves applying agile methodologies to existing firm practices that leverage drone technology. The agile approach emphasizes adaptability, collaboration, and the ability to respond quickly to changing circumstances. Moreover, the ability of drones to provide rapid data and insights allows marketers to respond quickly to market changes. Agile marketing principles support the flexibility needed to adjust strategies in response to emerging trends or shifts in consumer behavior.

Consider Tevel, an Israeli startup, that has developed groundbreaking robots that are specifically tailored for fruit picking (see Image 9.7). These autonomous flying drones utilize advanced AI and computer algorithms to harvest fruit efficiently and optimize the entire harvesting process.[59] Although the idea of using drones for apple picking is not entirely new, more and more companies are recognizing the potential benefits of agricultural drones and exploring how automation can contribute to efficient harvesting solutions. For instance, these agile drones can operate continuously, providing cost-effective solutions for farmers and real-time monitoring of the orchard's harvesting progress. The information collected by these drones provides valuable insights into the unique characteristics and contents of each bin before it is transported to the packing house. This data empowers growers to eliminate uncertainties related to market value, quality, and output while also enhancing on-site efficiencies.

Farmers can benefit from the use of drones, as they provide access to a plethora of information about the harvested fruit, such as its quantity, weight,

Image 9.7 Drones used in apple-picking
(*Source* Tevel technology, https://www.tevel-tech.com/)

color grading, ripeness, diameter, timestamp, geolocation, and other essential data. These drones are equipped with sensors and 3D cameras, which enable them to accurately identify ripe fruit, measure sugar content, and detect diseases. The drones are autonomous and have decision-making capabilities, some even utilizing electrostatic charges that mimic bee movements for pollination. Technology companies are leading the way in designing fruit-picking drones and tree-pollinating "paddles," to improve farm efficiency and agility in the face of labor shortages and climate change challenges.

Current Drone Applications in Marketing

Drones are quickly assuming an important role in the marketing function through their varied roles. They enable firms to integrate the power of scalable computing resources with enduring, affordable sensors that can function in most work environments.[60] When paired with other technological advancements such as virtual reality, AI, and ML, they also help in the creation of an environment in which businesses can make quick, accurate decisions based on rich information directly from the source. Since drones can substitute for conventional fuel-powered vehicles, they not only provide valuable assistance in transportation but also work in reducing congestion from the roads and containing harmful emissions. As a result, drones are becoming a valuable

addition to organizations in many industries that not only present value-creating opportunities in marketing but also hold important implications for the development of marketing strategies. This section presents five specific application areas where drones continue to help companies in developing marketing initiatives.

Understanding Customer Needs to Deploy Drones

Companies often look to automation to infuse operational efficiencies, establish competitive advantage, and provide exceptional service to customers. Consumers now demand innovative and technology-enabled devices and solutions to meet their needs. With the emergence of NATs, technology and consumer-level data have become inseparable. Companies can now gather rich and varied information from customer interactions that can be used to drive more value through the exchange. In this regard, drones can capture a wide range of information depending on the task it was designed for.

While a significant portion of drone data may be in the form of images of geospatial information, it provides an enormous scope for companies to do a lot more with such images. For instance, such images can be (a) processed into a sequentially/logically organized dataset to convey a visual message, (b) appended with other forms of data (e.g., thermal, chemical, physical, etc.) to learn more about a specific location, (c) illustrative in informing about the local conditions, (d) tracked over time to better understand a particular occurrence, (e) compared against similar or diverse forms of data to reveal further insights, and (f) easily delivered and consumed through smartphone apps. This vivid information can be indicative of customer needs and expectations that companies can focus on. As a result, drone data can subsequently aid companies in the development and implementation of marketing strategies.[61]

In consumer applications of drones, the deployment of drones is perhaps most impactful in delivery solutions. Especially in e-commerce, delivery options and perceived quality of delivery service are critical for consumers to shop online.[62] In a survey conducted by the European Union Aviation Safety Agency, respondents were asked how likely they were to try out delivery drones, assuming that drone delivery would cost about double today's standard shipping fees and would be guaranteed within 2 hours of placing the order. The results showed that 72% of respondents from Milan were receptive to trying out delivery drones, followed by residents of Barcelona (68%) and Budapest (67%). The more northern cities of Hamburg in Germany (59%) and the Nordics' Öresund (57%) were slightly less open to the idea.[63]

While consumers are more open to trying out delivery drones, they are also expressing more frustration in any instance of bad service. Specifically, a survey found that 84% of customers are more likely to spend more money to shop from a brand that provides great customer service. In contrast, 51% of consumers indicated switching to competition after 1–2 poor customer experiences.[64] The implication of such findings indicates that companies may not get a second chance to undo the effect of bad service experience and that they must be vigilant in all service experiences. In this current NAT environment, this implication is very pertinent to drone delivery and its effect on service experience.

Such survey findings are also in line with academic research that has highlighted the importance of minimizing service experience variance in establishing satisfaction and emotional attachment with consumers. Specifically, Kumar et al.[65] conceptualize that (a) the positive relationship between service experience and satisfaction is enhanced when the perceived variation in service experience is low and (b) the positive relationship between service experience and emotional attachment is enhanced when the perceived variation in service experience is low. Additionally, studies have shown that (a) technology has a global appeal and applicability concerning its relevance to real-time information,[66] (b) technology can render the time and place irrelevant for delivery of products and services (e.g., e-commerce, online banking),[67] and (c) technology can strengthen branding efforts that can result in a competitive advantage for firms.[68] Therefore, understanding customer needs vis-à-vis drone usage will enable brands to improve customer interactions and provide superior service experiences.

Revisiting Firm Capabilities to Integrate Drones

While drones can perform a wide range of tasks, firms can realize the full potential of drones only when the firm's capabilities and drone potential are aligned.[69] Given that drones have just emerged into the technology space, their utility to businesses remains to be seen. Therefore, companies investing in drones today will only see the results in the future. The implication is that firms must remain committed, able, and willing to reevaluate their business models and operations to include any new technological advancement to realize valuable gains. This is a crucial aspect of all NATs, especially drones. This is because, drone technology has significant commercial benefits as seen by (a) its conduciveness towards miniaturization, (b) lower costs of electronic components, and (c) a good testing ground for integrating other NATs such as AI, ML, and virtual reality.[70] Research has identified that firms that are

future-focused have been recognized as being more focused on adopting technologies that build their capabilities to manage future needs.[71] Regarding drones, firms must develop/update technological capabilities that can bring out the best results from a drone implementation. In this regard, academic research has studied the development of technological capabilities of drones extensively.[72]

With the emergence of drone technology, the development of technological capabilities may involve firms to be (a) open to newer technologies, changing dynamics, and business practices, (b) perceptive in managing risks, (c) led by strong and decisive senior management, (d) agile and in keen anticipation of market-related changes, and (e) innovative with newer technologies.[73] This involves firms having a deep understanding of their immediate and long-term firm requirements, goals, and challenges that make a real impact on the bottom line. Further, firms will also have to gain a clear assessment of the implications of adopting drones. In this regard, Kumar and Banda[74] propose that a firm's technological capabilities influence its propensity to adopt drones, in addition to other factors such as the readiness of its managers and customers, drone suitability for the business, and a regulatory framework.

Designing Marketing Mix Strategies With Drones

Like robotics, drones operate as a function-oriented technology, offering ease of use, value, and convenience to users in an application setting.[75] Given the newness of drone technology in business, a concerted effort at integrating drones into marketing strategy is noticeably absent. Current drone implementations in businesses appear to be ad-hoc in nature where drones as used in specific marketing tasks and not featured as part of a broader marketing mix strategy. However, this is likely to change in the future with drones demonstrating their impact on customer experience, operating costs, and bottom lines.

The evolving customer preferences and needs become apparent in a technology-focused environment. As customers and firms interact closely, learning occurs continuously. Specifically, the increased access to information about firms and offerings allows customers to evaluate the alignment of the proposed offerings with that of their values. Likewise, customers share their data with firms in the course of using products and services in a NAT environment. This creates a space for firms to know and observe more about their customers. Further, with the compiled customer data, firms can

provide customers with personalized experiences and offerings, thereby validating/updating their knowledge of the customers. In this cycle of firms and customers constantly evaluating and informing each other, information and knowledge are exchanged. This exchange powers the creation of value from and to firms and customers. Additionally, over time, such an exchange allows for the evolution and refinement of marketing strategies from firms that are aimed at creating value for both firms and customers.

A hallmark of the NAT environment is the presence of a business atmosphere that focuses on personalization, delivering positive experiences, productivity enhancements, and value growth (for firms and customers). This implies that firms direct their attention to understanding individual customer preferences to determine marketing mix variables. Further, this calls for firms to ascertain the various offering combinations of marketing mix variables that deliver the expected level of personalization, which is typically delivered through newer technologies.

With the increasing emphasis of firms on NATs such as drones to deliver positive experiences, firms also focus on monitoring and maintaining their devices/platforms, to increase productivity, improve efficiency, and reduce operating costs. For instance, drones are increasingly used to survey damage from natural disasters such as hurricanes, wildfires, and earthquakes. In such times of loss, consumers often depend on insurance to help them rebuild their lives. With drones being used in surveying damages, consumers can expect faster processing of insurance claims, thereby making a meaningful difference to consumers. Another area where drones can make a positive service experience is in delivery, as witnessed by the developments made by major companies such as Amazon, Google, DHL, and UPS.

Similarly, in-store navigation assistance is a key area that can result in positive experiences, as seen in the case of Walmart's proposed in-store drones for customer assistance[76] and in-store package pickup.[77] Given the assistance of drones with generating data-driven insights and delivering positive customer experiences, firms can potentially not only change the way they communicate with consumers in real time but also accurately measure the effectiveness of their marketing efforts, thereby increasing the opportunities for firm and customer value growth.

Driving Customer Engagement Through Drones

The topic of customer engagement has attracted significant practitioner and academic attention.[78] Practitioners worldwide continue to focus on developing valuable offerings while engaging with customers. Some of the

marketing functions in which customer engagement continues to be most visible include marketing communications, customer co-creation, loyalty programs, and social media marketing, among others. As with other NATs, drone technology continues to demonstrate its utility and value in many business settings (industrial and consumer), thereby steadily entrenching itself as a valuable tool in firms' customer engagement efforts. In doing so, two key drone capabilities are emerging as well-primed for more drone-related customer engagement efforts.

Interactivity. Drones were originally developed to perform automated tasks that were either difficult, dangerous, or dirty for humans. This implies that interactivity was not an intended feature of drones. While this automation may be well-suited for many industrial situations, consumer applications may require drones to have interactivity as a capability. This is because the customer-focused market structure dictates that it is vital for firms to establish a long-term value-driven relationship with their customers to enjoy continued patronage and financial robustness. With the increasing popularity of drones and the high number of consumer applications, interactivity is now a feature that drone developers are focusing on. An example of drone interactivity can be seen in the case of the Hyderabad, India-based Biryani By Kilo. The fast-food seller specializing in biryanis decided to launch an initiative to deliver biryanis by drone. Along with the initiative, the company paired it with a social media campaign by engaging with social media influencers based in Hyderabad. The initiative and the social media campaign were a success with nearly 815 thousand views, around 85 thousand engagements, and a 44% increase in sales after the campaign.[79] This shows that drones can be made interactive when integrated within a company's marketing campaigns.

With advances made in speech recognition technologies, it is possible to equip drones with audio response capabilities (e.g., such as Alexa) that can interact with consumers in an exchange setting.[80] Such a feature will be most useful in situations like customer deliveries, in-store assistance, and navigation, customer assistance in public attractions (e.g., malls, museums, and amusement parks), and event management venues (e.g., queue management), among others. These applications are likely to enhance customer engagement as the drones will have the ability to instantly respond to customer queries.

Delivery. Drones are poised well to disrupt the delivery business, especially in fulfilling orders in highly populated areas. Many companies across countries have initiated delivery programs using drones. Some of the prominent ones include DoorDash launching a drone pilot program in the Southeast Queensland region in Australia, Walmart partnering with four drone delivery companies to establish drone delivery hubs in seven US states, Tesco

launching its drone delivery service in Galway, Ireland, and Chinese food delivery platform, Meituan, starting drone delivery operations in 2021.[81] Consider Amazon, for instance. Most products sold by Amazon weigh five pounds or less.[82] Many drones are equipped to handle this weight. Therefore, this is an area that online retailers are looking at with great interest and one that can enhance customer engagement in a significant way.

However, given the limited air space, it is likely that firms will face challenges in drone delivery, with several instances of collision and property damage. Here, a traffic management system (TMS would help firms and users to have efficient usage of air space and serve as a way to enhance customer engagement. For instance, NASA is working on creating a platform known as the UAS Traffic Management (UTM) to create a system that can integrate drones safely and efficiently into air traffic that is already flying in low-altitude airspace.[83] Such a system is expected to monitor and regulate package delivery and hobby drones from intruding into the air space of regular air transport (e.g., airplanes, helicopters) and first responder drones.

Designing Digital Strategies With Drones

In the fast-evolving NAT environment, media and consumers are increasingly going digital. For marketers, this change presents important implications in two key areas—solutions-focused offerings and changing user demographics.

Solutions-focused offerings refer to those types of offerings that directly relate to customer requirements by leading them to the solution they seek rather than going through a long search process. When faced with choices, consumers typically look for more information to help them make decisions. While new information (e.g., competing offerings, alternative solutions) may be acquired through traditional and/or digital means, it also assists in avoiding decision regret,[84] and thereby helps consumers feel confident about their choices. Further, when consumers face a non-routine (or less frequent) decision, they would likely seek more information to assuage their concerns. Seeking and processing large amounts of information may lead to "information fatigue" and potentially an unsatisfactory decision-making process. In this regard, digital strategies can facilitate faster decision-making by shortening customers' purchase journeys and making them more efficient and convenient. When companies use drones in their marketing programs, the level and depth of information that is communicated is very rich and informative to the viewers. For instance, using drone footage/images in commercials provides dramatic aerial views that convey much more than traditional ground-based footage/images. Often captivating, drone images

Table 9.2 Changing nature of user demographics in the United States

User age group	Percentage of adults who								
	Own a smartphone in…			Use social media in…			Own a tablet computer in…		
	2012	2018	2021	2012	2018	2021	2012	2018	2021
18–29	66	94	96	81	88	84	20	63	61
30–49	59	89	95	64	78	81	12	56	53
50–64	34	73	83	39	64	73	10	50	46
65 and above	13	46	61	16	37	45	6	38	44

Source Faverio, M. (2022), "Share of those 65 and older who are tech users has grown in the past decade," *Pew Research Center*, January 13, accessed from https://www.pewresearch.org/short-reads/2022/01/13/share-of-those-65-and-older-who-are-tech-users-has-grown-in-the-past-decade/

add dimension and movement to the marketing content, thereby nudging them towards a decision.

The changing nature of user demographics has moved towards digital avenues. While younger users are known to be early adopters of technology compared to older users, the rate of adoption of newer technologies by the oldest age group has increased significantly in recent years. Particularly, a recent survey has found the gap between the oldest and youngest adults has narrowed. The results of the survey are presented in Table 9.2.

As shown in Table 9.2, among Americans 65 and older between 2012 and 2021, there was a nearly five-fold increase in the ownership of smartphones, a three-fold increase in the usage of social media, and a seven-fold increase in the ownership of a tablet computer. While other age groups also showed increases, it was not as significant as the 65 and older group.[85] The implication of such generational shifts is, that firms that can take advantage of ongoing developments in drone capabilities, drone electronics, and sensors; creatively use drone data and insights; plan drone deployment in a precise manner; and implement digital strategies that involve drones in the right measure can reap impressive rewards while delivering the most value to consumers.

Future of Drones in Marketing

With the rapid progress made in technological innovations, the future looks loaded with gadgets, algorithms, and platforms. As with all NATs, drones too will become a regular feature in our daily lives. As we move towards a data-rich and innovation-focused environment, the presence and

usage of consumer data by firms, the quality of insights generated, and the way technology is used to implement solutions based on the insights will inform the usefulness and relevance of marketing strategies.[86] While a technology-intensive future is inevitable, firms must adopt a customer-focused approach while designing marketing strategies that create value for firms and consumers. Drones will undoubtedly continue to impact marketing strategies and marketing practices. In doing so, the lessons learned from drone implementations and the marketplace changes will continue to drive future drone implementations. While we can expect progress in drone capabilities in many organizational areas, three areas that stand out are discussed here.

The "Good," "Bad," and "Ugly" of Drones

It is apparent that personalization has increased tremendously, and data is being generated in more ways than one can expect. While there have been a few concerns over the role of these technologies, drones require specific attention. Here, three perspectives about drones are presented—the "good" (why we must embrace drone use), the "bad" (that which must be worked on), and the "ugly" (that which must be re-evaluated) to facilitate decision-making for customers and organizations.

The "Good." As discussed earlier, drones have many uses that benefit society such as for inspection in law enforcement, construction, and safety and disaster management, among others. Drones are also being used in ecosystem management for identifying poaching or illegal deforestation—they were used in Kenya in fighting poachers. Drone photography and videography also have a transformative effect on humans. In business contexts, drones are used by firms to offer better customer experiences. In 2016, Domino's Pizza flew the peri-peri chicken, chicken, and cranberry pizzas to a couple in Whangaparaoa, New Zealand—the first people in the world to get pizzas delivered by drones.[87] Around the same time, Amazon delivered their goods using drones, following the Amazon Prime Air business model.

The "Bad." It is to nobody's surprise that drones have infiltrated our daily lives with ease, but the long-term consequences of this action are relatively underexplored. Drones are a safety threat. When operated by inexperienced fliers, when poorly made, or when flying in unfavorable conditions—they may fall out of the sky unexpectedly (susceptible to engine malfunctions). Additionally, there are rising concerns over drones' invasion of privacy. The idea of a drone flying above people's homes and capturing images to store as

data is very unsettling to many. These are being mitigated by drone manufacturers and developers—they are developing new technologies; cameras that automatically blur or pixelate faces. Customers are using privacy screens to block the view of their homes, some apps detect drone presence around set premises.

The "Ugly." Flying drones over crowds is becoming common nowadays—this is a serious hazard as drones could collide with other people or objects in the crowd. They are also very noisy, contributing significantly to noise pollution. Drones are being equipped with weapons and are being used to carry out other criminal offenses. Drones flying in restricted airspaces are also picking pace—in 2014, a helicopter-style drone nearly collided with an Airbus 320 taking off from Heathrow Airport in London. Such acts pose a serious threat to humanity, only regulations and awareness can reduce the possibilities.

Enhanced Customer Experience

Drones are continuing to prove their worth in improving customer experience. As evidenced by the above discussion, while drone technology is a game changer in improving customer experience in end-user-focused interactions, drones also work just as effectively "behind the scenes" in delivering a superlative experience. In the future, this ability of drones is only expected to increase as more firms see value in such implementations. A few such drone implementations are discussed here.

Consider the insurance industry. This industry was one of the first to begin using drones for claims inspections. Companies such as Allstate, Travelers, USAA, and Liberty Mutual are using drones for damage inspection and processing claims, with more companies planning to adopt drones.[88] Whereas claims inspection is but one function for insurers, drone deployment is being evaluated or used in many more functions. Specifically, drones are being considered for assessing the loss before and after a negative event occurs. Regarding the determination of loss before a negative event occurs, drone data and inputs are used in calculating premiums, including risk mitigation clauses in the insured property, and collecting information relating to potential threats from natural disasters. Once a loss-creating event has occurred, drones can be considered for assisting in several tasks such as inspecting damages to property and lives, assessing risks to avoid future losses, processing claims, and validating damages to prevent insurance fraud, among others. While all these actions may not occur in direct interaction with customers,

their involvement in the background ultimately impacts how insurers manage customer expectations and provide superior experience.

Consider the public utilities industry. Drones serve a vital use in assisting with aerial surveys for maintenance purposes. For instance, critical infrastructure such as power lines, communications towers, roads, rivers, bridges, etc., needs routine maintenance and monitoring, to avoid any service failures. While trucks, helicopters, and boats are typically used for such maintenance purposes, it is often expensive and could place members of the maintenance team in hazardous conditions. Here are three examples of drone usage by public utility companies.

- An early user of drones, Dominion Energy in Virginia has been using drones for routine power line inspections since 2014.[89] Recently, the company also won approval from the FAA for expanded beyond visual line of sight (BVLOS) drone flights. The company expects such advancements in drone usage to serve its customers better by providing a superior service experience.
- In 2017, the New York Power Authority (NYPA) tested the use of drones to inspect the Niagara ice boom for any damages and preventive maintenance. While it can cost $3,500 for a helicopter or $3,300 to send a crew of four for a full-day inspection by boat, a drone could cost only $300 per trip, thereby leading to valuable cost savings.[90]
- In 2017, Oklahoma Gas and Electric (OG&E) recently deployed inspection drones to speed up storm assessment and restoration times during winter storm Jupiter. By continuing the use of drones to undertake advance inspections of power lines, wind farm turbines, and plat equipment, the company estimates the outage duration to have been reduced by 50%.[91]

Essentially, by reducing the number of breakdowns and/or providing more accurate information on service restoration, such implementations are expected to ultimately provide a better customer experience for users of public utility companies.

Customer Contact Solutions

Drones have the potential to demonstrate improvements in product development and enhancement, process optimization, and derive deeper insights for decision-making when well-integrated into marketing strategies. Further, they can help firms master the knowledge of consumer preferences, and deliver personalized products, pricing, and advertising content through

relevant channels. Several companies continue to use drones for display advertising that can be eye-catching while being economical. For instance, Moscow-based Wokker Noodles used drones to carry small promotional fliers past the windows of Moscow office buildings, informing the lunch specials just as people were getting ready for lunch. The success of this innovative campaign was immediately observed with lunch deliveries in the campaign areas increasing by 40%.[92] Other major brands such as Red Bull, Coca-Cola, GE, and Intel have used drones for advertising and promotional marketing campaigns.[93] Such initiatives have significantly helped the brands stay closer to their consumers.

Another area where drones can serve as effective customer contact vehicles is event marketing. Visitors to an event serve as a committed audience to which firms can pitch their offerings. Given that the attention of the audience is at a high level, an innovative way of communicating the marketing message will likely have a high impact. For instance, when events are covered via a live stream using drones, in addition to the regular mode of coverage, consumers get an immersive experience of the event. Examples of such experiences include recreational adventure sports (e.g., hang gliding, paragliding, parasailing, etc.), indoor sporting events (e.g., drone cameras for capturing close-ups and replays), drone racing, behind-the-scene footage of live events, and so on. When brands make their presence felt during such events, consumers may associate those brands with positive experiences thereby boosting the brand image and recall. The Intel Drone Show at the *Pepsi Super Bowl LIII Halftime Show* is an example of how brands can elevate the memorability of an event while making its presence felt .[94] Further, the company has performed more than 600 light shows in over 20 countries, signifying the value of drones as a prized, innovative event management tool that can benefit brands and consumers.

Drones can also make a significant positive impact on customer satisfaction by enhancing the quality of customer interactions during a purchase event. Drone delivery is a good example of this. With many companies like Amazon, Google, DHL, Flirtey, and UPS rapidly increasing the technological capabilities of drones, regulatory bodies are now beginning to facilitate and simplify the regulatory policies governing the use of drones in business.[95] Such actions are further expected to lower the barriers to entry for other drone adopters, drone developers, and drone service providers, thereby creating a vibrant drone ecosystem.

Key Terms and Related Conceptualizations

Drone	An unmanned aircraft that can fly autonomously
Drone racing	A sport that requires the drone operator to wear a first-person view (FPV) headset device that is connected to a camera mounted on the drone
Fixed-wing systems	Fixed, static wings in a drone that can aid with forward airspeed to generate lift
Hybrid systems	Drones that possess characteristics of fixed-wing systems and multirotor drones
Multirotor drones	Drones that are equipped with multiple small rotors, at least four, to allow them to hover in the air, be noiseless, and be lightweight
Payload	The weight a drone can carry
Remotely piloted aircraft (RPA)	A sub-category of an unmanned aircraft where the flying pilot is not on board the aircraft
Remotely piloted aircraft systems (RPAS)	A set of configurable elements consisting of an RPA, its associated remote pilot station(s), the required command and control links, and any other system elements as may be required, at any point during flight operation
Remotely piloted vehicle (RPV)	Class of UAVs designed to have some degree of interaction with a human controller via a data link but may possess autonomous flight control capability
Unmanned aerial vehicle (UAV)	Aerial vehicles that provide wireless connectivity by transmitting data remotely, and typically without an onboard pilot
Unmanned aircraft system (UAS)	An aerial system is made up of many sub-systems that include the aircraft, its payloads, and the control station(s). Essentially, it's an aircraft with its crew removed and replaced by a computer system and a radio link