

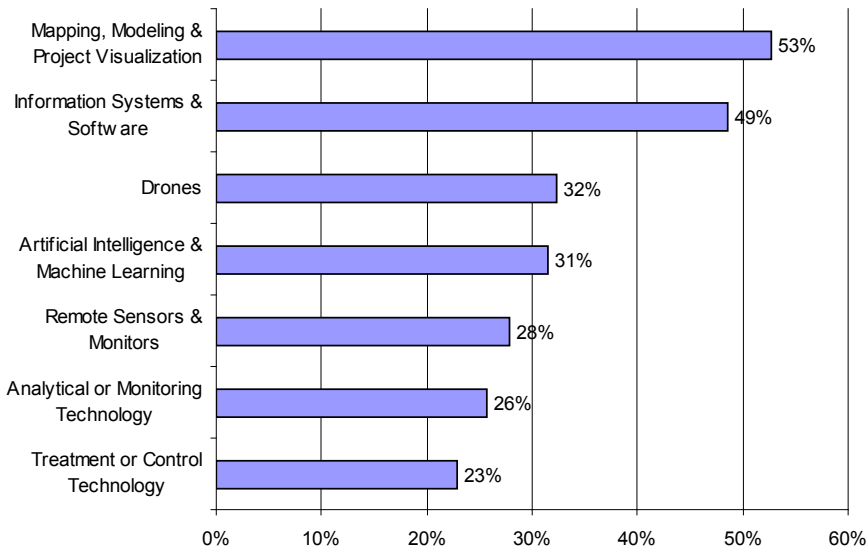
TECHNOLOGY AS THE DIFFERENTIATOR

Knowledge and perspective on technology has always been a differentiator in the environmental industry. Firms have developed \$100 million value propositions on a single technology. Others are technology agnostic: purporting to equally represent every technology available in the tool bag to make the most cost-efficient and enduring solution for their clients. So whether a service provider or a technology developer, or whether a consultant or a contractor, staying at the forefront of technology development and implementation is a key element in environmental industry competitiveness.

But not all technology is created equal. And not all technology works as intended or expected. And few and far between is the client or project that is willing to be experimented on. Equally elusive is the client willing to fund innovation on a project by project basis. The traditional regulatory paradigm behind prescriptive technologies or guaranteed results for treatment, pollution control, analytical methods or other processes across the environmental industry also serve to suppress or inhibit innovation. And while these barriers to technology innovation are important, they aren't the primary focus of this review. And while treatment and pollution control technologies are also important, they aren't the primary focus of this review either.

The technology revolution of the 21st century is about Information Technology (IT), and the revolution continues to be in full gear, if not accelerating, in 2023. From the mainframe to the personal computer to the smartphone and the interconnection of devices, and from data sharing to the internet and the cloud to computational models and artificial intelligence today, the pace of change has been persistent—and an underlying challenge of being in any business.

Areas Where Firms Have Significant Investments in Technology



Source: 2023 Survey of Disruptive Technologies in the Environmental Industry, EBI, Inc. Question was: What is the level of investment that your company is putting into the following technologies. Percentage are categories rated by respondents as 'very significant' or 'significant' investment in technology in 2023: just the top 7 of 18 displayed.

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Deployment of Technologies in Environmental Projects: 2020-2023

	2023 Deployment	2020 Deployment	2023 vs. 2020
IT Systems & Software	52.5%	52.2%	0.3%
Mapping, Modeling & Visualization	47.4%	41.1%	6.3%
Analytical or Monitoring Technology	34.3%	44.0%	-9.7%
Treatment or Control Technology	22.5%	31.0%	-8.5%
Remote Sensors & Monitors	20.3%	22.5%	-2.1%
Satellite Technology	19.1%	19.4%	-0.3%
IoT or Connectivity	17.8%	14.4%	3.4%
Power Generation Equipment	15.3%	11.9%	3.4%
Energy Efficiency Systems/Equipment	14.6%	14.2%	0.4%
Drones	13.3%	9.6%	3.7%
Automated O&M Systems	12.0%	n/a	
Artificial Intelligence & Machine Learning	8.2%	8.8%	-0.6%
Power Storage Equipment	6.6%	7.5%	-0.9%
Automated Compliance/Permits	5.7%	n/a	
Robotics	3.8%	4.2%	-0.4%
Augmented & Virtual Reality	3.4%	5.6%	-2.2%
3D Printing	0.6%	3.5%	-2.8%
Block Chain	0.5%	3.0%	-2.5%

Source: 2023 and 2020 EBJ Survey of Disruptive Technologies in the Environmental Industry, EBI, Inc. Question was: Indicate the percentage of projects in which you are using the following technologies.

EBJ Respondents by Segment

Environmental C&E	20%
Remediation	16%
IT & Tech	11%
NRM/CRM	8%
AEC	6%
Investigation	5%
Remediation Tech/Eq	5%
Air Quality	3%
Compliance	3%
Statistics/Risk	3%
Sustainability	3%
Water/Wastewater	3%
Energy	2%
Infrastructure	2%
RNG	2%
Renewable Energy	2%
Solid waste	2%
Transportation	2%
Waste Management	2%
Water Instrumentation	2%
Water Testing	2%

Source: 2023 EBJ Survey of Disruptive Technologies in the Environmental Industry,

by the fact that we have more data due to better and more detailed data collection apparatus—putting pressure all the way along the continuum toward the ultimate goal of actually making a decision. And all this data and information taxes the human brain enough that we are becoming increasingly reliant on digital processes to make sense of the data and convert it into useful information and actionable intelligence. Hence today's obsession with artificial intelligence (AI) and debates about its ability to transform business and society in many ways.

But how are we using these tools to address today's challenges? And how is the environmental industry using technology to advance its ability to satisfy client needs and optimize its own business operations facing a changing future? Seeking answers to those questions, Environmental Business Journal conducted its second thorough survey of environmental service and technology providers in the summer of 2023, repeating a similar survey conducted early in 2020.

The results of EBJ's 2023 Survey of Disruptive Technologies in the environmental Industry are summarized here on these pages, and indicate some key trends that are affecting, and will increasingly affect the environmental industry throughout the rest of the 2020s and beyond. Along with this analysis we present some results of surveys conducted by peers in the industry that find an unsurprising recent surge in capital expenditures and operating

DATA-INFO-INTEL

So where are we in the development of Information Technology in the environmental industry? And how are we advancing on the continuum in our ability to collect and manage data, produce data into aggregated information, and assemble the appropriate information into actionable intelligence? Managing this data-information-intelligence continuum is not easy, but the difficulty is compounded

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SWCA USES IMAGING TECHNOLOGY TO GET BOOTS OFF THE GROUND AND FRONT-ENDS PROJECTS WITH ChatGPT

Since 1981, SWCA has helped public and private clients overcome environmental challenges and move their projects forward. Our 100% employee-owned firm offers comprehensive sustainability advisory, environmental planning, regulatory compliance, and natural and cultural resources management services. We work together to understand the full life cycle of any project, from inception to completion. In the face of rapid environmental, economic, and societal changes, our purpose is simple: to preserve natural and cultural resources for tomorrow while enabling projects that benefit people today. We do that by offering a suite of environmental consulting services combined with local knowledge, regulatory expertise, and high-quality service. We build long-term, trusting relationships with our clients and guide their projects to successful completion. With a global presence, SWCA is able to rapidly pool resources and respond to our clients' needs.

Linda Lannen, Chief Technology Officer. Ms. Lannen has more than 20 years of experience in the AEC industry, tackling the most daunting of technology projects, including ERP system replacements, wide area network migrations, data center to cloud migrations, and implementations of enterprise security programs. She has previously worked for a variety of firms, ranging from dot-coms to Fortune 500 companies, and across industries including environmental engineering, telecommunications research, and food manufacturing.

EBJ: In which ways is advanced imagery adding value to our industry? Which new technologies are coming out and how do you think that those technologies will evolve over the next 5 years?

Linda Lannen: We have developed unique capabilities to leverage imaging from a variety of sources – satellites, fixed wing and rotor wing aircraft, drones, and people on the ground. Satellite data is great for monitoring site changes over time, whether it's construction, vegetation, or damage from natural disasters.

We currently employ a variety of sensors, as well, from LiDAR to multi-spectral and infrared, to meet our clients' needs on diverse projects. One of the most exciting new services we offer is methane gas leak detection from our UAVs. The ability to pinpoint which fitting on a well is leaking provides actionable information to our clients. Other services we've seen can show which field has a leaking well, but they can't identify the specific fitting. The level of specificity we provide saves the client money, and it's good for the environment because we can address issues promptly.

We are shifting from the literal boots-on-the-ground model for some of our fieldwork – which is the most expensive for our clients – to offering incredibly high-resolution and near-real-time satellite data that's approaching 30cm/pixel. Our clients constantly remark on the high quality of the imaging we can provide without having people on the ground. Having this actionable information on a timelier basis enables our clients to make better decisions that positively impact their business and our planet.

EBJ: Tell us about Artificial Intelligence. How is the industry leveraging emerging capabilities to lower costs and increase insight?

Lannen: "Artificial intelligence" includes a wide set of tools – some have been in use for decades, but the ChatGPT craze has brought others out of the shadows. Five years is a lifetime in the technology world – but I do think that machine learning will be more fully integrated into our workflows. I look at tools like ChatGPT as having a research assistant who can start that presentation or report. It saves time on tasks we'd rather not do ourselves, and it can identify trends that we might miss. The experts can then assess what these

tools produce, fact-check, fine-tune, and deliver a faster and higher quality service.

Over the past few years, we developed several computer vision and audio models to identify field items and species, which have been very useful with endangered species, invasive species, and cultural artifacts. Those are useful in a somewhat limited manner. Real insight provided with AI will be in complex mathematical models and in identifying trends – think of greenhouse gas emissions and similar scientific insights – as well as in mapping the impact of coastal erosion and sea-level change. For example, one of our scientists has developed a model predicting where oyster beds are likely to be along a coastline. The results help paint a large picture of where oysters are probably located. That information can then assist scientists on the ground who are inspecting and ground-truthing those locations. When you combine these AI tools with maps, the issues come to life for people as they relate to geospatial data more than charts and spreadsheets.

The industry absolutely needs to shift to leveraging more technology – whether simple automation or more complex AI large language models (LLMs) to automate mundane, repetitive tasks. This frees our experts to focus on the truly innovative, creative thinking that goes into protecting and restoring the environment.

EBJ: Is ChatGPT just the latest technology flavor of the month? Or is it and other Natural Language Processing platforms generating real usable outputs suitable for work products? And please provide some examples of where AI is contributing real short-term value, and to what types of project work?

Lannen: ChatGPT and other LLM tools are demonstrating the value of Artificial Intelligence in a more "consumerized" version. Previously you needed to understand data science, some R programming language, and a bit of advanced statistics to be able to leverage AI tools. I see these LLMs as some of the first tools that anyone can use for a wide variety of tasks.

SWCA is leveraging these and other AI tools for a wide variety projects, from species identification to assisting with re-

port writing. We have an AI task force that is a fantastic combination of data scientists, project leaders and field scientists who are collaborating and prioritizing the many requests our Technology team receives for using tools on projects and in corporate services. We are using it to sift through public comments databases, and for a number of geographical delineation projects. The speed with which you can process data and identify trends is remarkable – and the secret sauce in using AI is to pair it with our scientific expertise. Using it alone gets you a certain distance, but you need to have expertise to train the models.

EBJ: How have your IT budgets changed over the past couple of years and what do you expect in the near future? And how do you see those budgets being allocated?

Lannen: Most firms' technology budgets have shifted a lot of capital expense to operating expense as we have adopted more cloud and SAAS technologies. It's not necessarily cheaper, but it's a change. I also see IT evolving from a pure cost center to becoming a hybrid P&L as we work with our consulting colleagues to deliver data-driven solutions to our clients.

EBJ: How did you get involved in the Environmental industry in the first place and what were some of your early Inspirations or mentors or leaders that inspired you further?

Lannen: I first got involved in the Environmental industry when I went to work for a technology startup/subsidiary of MWH Global in 2002. They were later absorbed into MWH. This is where I met the late Dr. Vic Gulas, who was a tremendous mentor and sponsor for me. He was the Chief People and Knowledge Officer (best title ever!) at MWH Global. His work included that intersection of people, knowledge and technology – and we did some notable work on social networks (how work gets done and how you develop trust among teams) that influences and inspires me today. Another great mentor and friend for me is Kathryn Simon, who taught me that you can be a manager, leader and a friend, and how to juggle those hats with your team.

EBJ: What evidence of climate change or environmental degradation have you experienced personally in your lifetime?

Lannen: One impact of climate change that I've experienced – I moved to Southern California 12 years ago, and am blessed to have two homes in a coastal region and in the mountains. When I first

moved here, most people didn't have air conditioning in either place. Now, people are installing A/C in droves in both areas as the temperatures rise for longer periods during the summer. Clearly this is a first-world "problem," but it is remarkable to me that it's happened in both places and only over a decade or so. ■

ECOFORESTS FINDS FAMILY OFFICES ARE KEY INVESTORS IN SUSTAINABLE TIMBER; FORTUNE 500 SHOWS INTEREST IN CARBON PROJECTS

EcoForests (Toronto, Ontario) is a boutique forestry investment management firm managing high class tropical timber plantations on behalf of investors with two types of projects: sustainable forestry projects; and reforestation and afforestation carbon capture projects with fuel conservation and watershed protection. Michael Ackerman is the president and chief executive officer of EcoForests Asset Management. Ackerman is originally from Honduras and has served as CEO at EcoForests for twenty years, expanding from timber to carbon sequestration. Ackerman also applies his expertise of the economic and environmental benefits of managed-forestry investments as an advisor for the Green and Transition Finance Council for the Canadian Chamber of Commerce.

EBJ: When was EcoForests founded, and how did you find your niche?

Michael Ackerman: EcoForests was founded in 2003. Our company began developing small forest farms with a group of high net worth individuals (HNWIs), through my own family's business network, and soon after a number of family offices gained interest in our projects. By word of mouth, we have been developing projects for family offices, mainly from Europe, across Costa Rica and Honduras with some other projects in Panama and South America.

EBJ: What type of investors have demonstrated interest in EcoForests?

Ackerman: HNWI, family offices, and most recently funds have invested in our sustainable timber projects. Family offices are focused on wealth preservation and wealth transfer, and because of their ability to hedge against inflation, forestry is an ideal investment for them. In addition, newer generations in family offices have a stronger concern for the environment, and seeking alpha is not the most important factor; they place the environment and net zero goals before profits. In addition,

a slew of Fortune 500 corporations have expressed interest in our newly established carbon offset projects.

EBJ: How is investment money allocated, and what is the real value that EcoForests provides to the communities where investments are made?

Ackerman: Investment funds are utilized to purchase deforested farms. We mechanize the soil and add nutrients such as calcium and potassium to prepare for planting. Meanwhile in our own nurseries work is being undertaken to select the right seeds and saplings. After 2-3 months in the nursery the trees are brought to the farms and planting begins. We are committed to the communities from where we operate, and we dedicate 3-5% of the invested capital to building schools, sponsoring local sports teams, and offering scholarships to students. A portion of the invested capital remains in escrow for management costs over the lifetime of the investment.

In Honduras, we donated early fire detection sensors to a national park that is prone to forest fires in the summer months – we hope to continue expanding the ways in which we give back in the future.