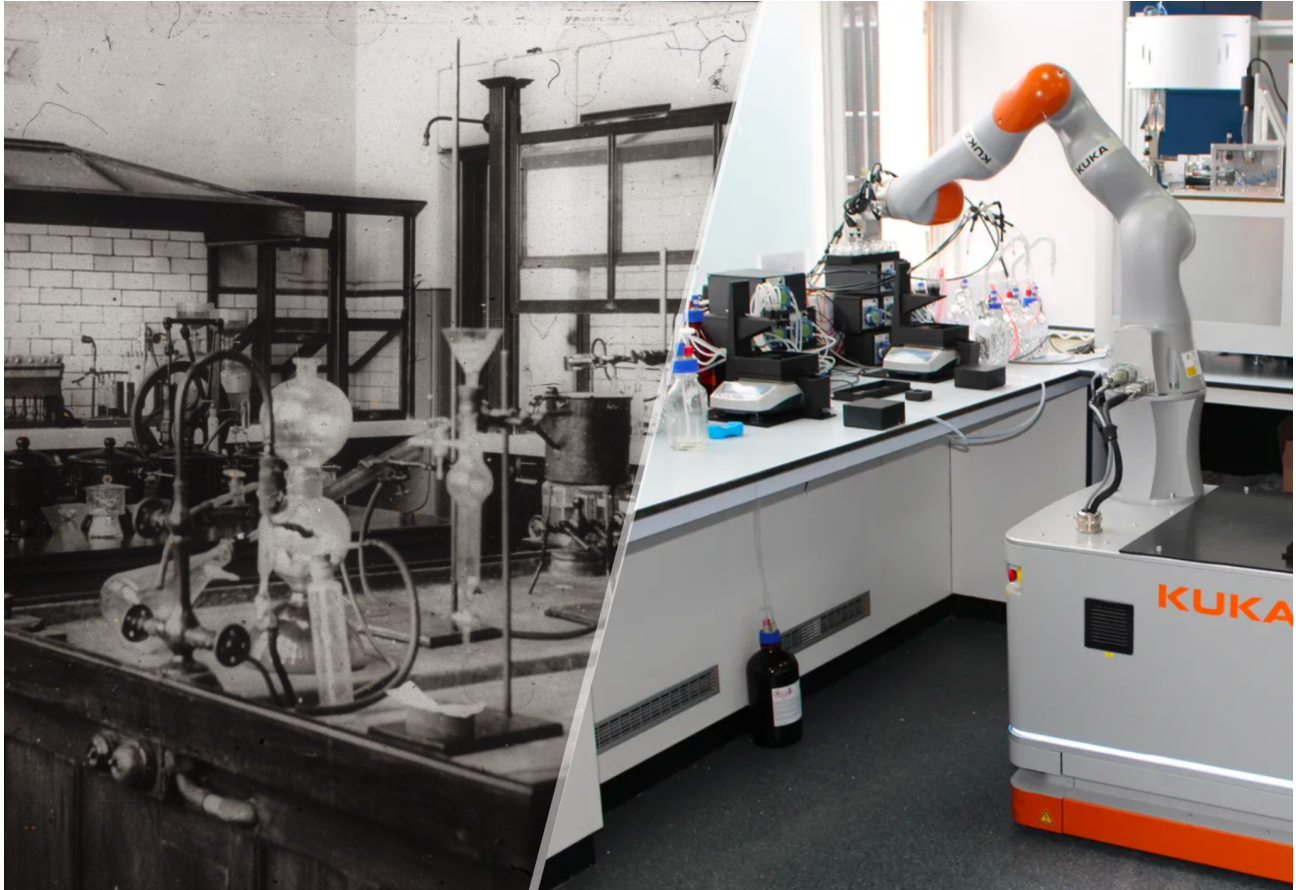


Lab of the Future (LOTF): Utopian Paradise or Dystopian Dysfunction?



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Pistoia Alliance hosts an active community of User Experience professionals in the Life Sciences ([UXLS](#)). This community collaborates on multiple workstreams to develop and deliver numerous best practice guides, blogs, and toolkits to increase the adoption of user experience (UX) practices in life sciences. The UX Lab of the Future workstream spent 18 months applying a user experience lens to the concept of research laboratory digital transformation, culminating in a hands-on workshop at the 2022 UXLS annual conference. Tickets for the 2023 UXLS Conference in Stevenage, UK, are available now.

Abstract

This article explores the concept of the "Lab of the Future" (LOTF) through the lens of user-centred digital transformation in research laboratories. Digital transformation initiatives, aimed at implementing technological advancements in business processes, are seen as essential for improving efficiency, agility, and value across various industries. In the biopharma sector, where digital innovation is considered a competitive differentiator, successful implementation of digital initiatives is critical for research and development (R&D) organisations. Our work demonstrates the desirability of avoiding big bang transformational approaches and instead using a user-centred, iterative approach that makes gradual improvements that have meaningful impact.

Digital Transformation Dystopia

An internet search for 'LOTF' yields two main results: "Lab of the Future" and "*Lord of the Flies*". One refers to digital transformation applied to research laboratories; the other is a dystopian novel that describes what happens when change is thrust upon a set of characters who have no outside guidance to ground them. Is it coincidence, or fate, that these two disparate ideas share a common acronym?

Success with New Ecosystems

Digital transformation initiatives are at the heart of the Lab of the Future. These initiatives are the [processes by which companies embed technologies](#) across their business to drive change, with the objective of gaining increased efficiency, greater business agility, or unlocking new values to employees, customers, and shareholders. In a 2021 [Deloitte survey](#) of 150 large biopharma leaders, 77% said their organisation views digital innovation as a competitive differentiator.

Anecdotally, in the biopharma industry, there are tales of successful digital initiatives, and there are tales of complete chaos and non-compliance. [Research by McKinsey](#) in 2019 states that 70% of all digital transformations will fail. Not unlike the business process re-engineering craze of the 1990s, digital transformation initiatives [can go awry](#) and lead to worse results if applied haphazardly. In the "[Lord of the Flies](#)", the importance of reason and intelligence are explored as tools for dealing with chaos. We wanted to explore ways to ensure digital initiatives were implemented with reason and intelligence, giving both end users and the business the tools they need to be successful in a new digital ecosystem.

Our team aimed to apply user research principles to understand how LOTF initiatives can successfully be implemented in [biopharma R&D](#). *"While a digital transformation can change the paradigm of an organisation, the most important assets of the organisation, its people, will need to have easy and pleasant experiences with the vast array of new data and technologies at their fingertips, or the transformation will fail. UX professionals need to be at the heart of ensuring that digital strategies are set up for success."*

User Research Findings

Realising that different labs are at different stages of digitalisation journeys, we chose to focus on *in vivo* sciences. *In vivo* research is believed to be the most challenging area of drug discovery to digitalise due to the complexity of the workflows, variability of experimental conditions, and the need for real time decision making for animal welfare.

Through a series of user interviews with various stakeholders, including hands-on animal laboratory technicians, supervisors, veterinarians, study designers, data collectors, and IT personnel, we asked what lab of the future meant to them. Our initial hypothesis was that people would ask for new and innovative technology, such as artificial intelligence, IoT (internet of things), and virtual reality. What we learned, instead, was that our initial assumptions and hypotheses were completely wrong.

“If you asked me that a year ago, I would think of a Jetson-style laboratory...[an] animal room where there’s robotics dosing animals and doing those things.”

Throughout our research, one recurring theme emerged: Lab of the future visions are often looking **too far ahead**. Our *in vivo* stakeholders desired a more simple future state, one where data and animal interactions were at the heart of decision making. When asked what LOTF meant to them, they noted “...*better than the lab of the present*” and “*lab of the future means bringing the lab into the 21st century*”.

Stakeholders consistently noted that sci-fi visions of digital screens and robots are a common theme in digitalisation conversations, however the current needs are far more relevant to them, even if they don’t factor in the latest technology.

As one stakeholder remarked, “If you asked me that a year ago, I would think of [*Jetson-style laboratory*](#)...*a Jetson-style animal room where there’s robotics dosing animals and doing those things. As we’ve found our rhythm with this type of thought process, what it means to me now is really finding opportunities to create efficiency for operational staff that facilitates documentation or the ease of how we interact with the animals so we’re forever focusing on what I think are the most important things: the animals and the science.*”

Stakeholders noted the difficulty with changing the mindset of scientists, where spreadsheets are the default and preferred data collection tool. However, they acknowledged that the near future needs to focus on centralising lab software and data, structuring data in a relational database, and bringing data directly into a system that can integrate with other tools, all while ensuring reproducibility and compliance of studies.

Digital Maturity Assessment

While our findings did not encompass an immediate need for futuristic, cutting-edge technology such as virtual reality (VR) goggles, they did uncover an immediate need for crucial process change. We realised that our *in vivo* stakeholders required fundamental changes to operational processes, like documentation and data collection. Our major insight was that the lab of today requires a “**Lab of Tomorrow**” before the Lab of the Future can be implemented.

Using the [Lextech Data and AI maturity model](#) as a guide, we mapped our user research findings and discovered that many of our *in vivo* stakeholders were currently in stages 1 and 2: Manual Data Drudgery and Death by Dashboards (Figure 1). From a User Experience (UX) lens, we believe that using a data maturity model like this is key to a successful digital transformation. Stakeholders can identify where they are on their journey and develop more realistic step-wise goals for digital transformation. Each of the steps represent a “Lab of Tomorrow” scenario that will help organisations move closer to the future of a truly transformed organisational ecosystem.

Data + AI Maturity

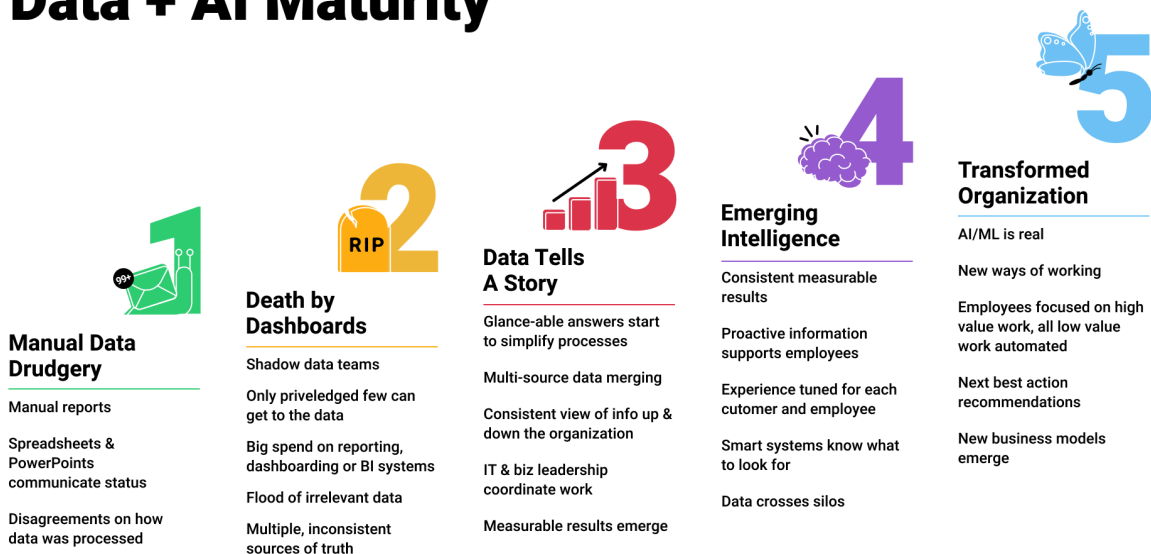


Figure 1: Data and AI Maturity model, by Lextech

Research at All Stages of the Journey

In October 2022, at the User Experiences for Life Sciences conference in Cambridge, UK, we conducted a 2 hour hands-on UX ideation [workshop](#) based on emerging needs that participants of our user research identified, needs that organisations in stages 3 and 4 of the data maturity model had identified. User experience professionals from large pharmaceutical companies, biotechs, and all collaborated to ideate on the use cases.

Four *in vivo* use cases were presented for research and ideation.

1. Integrated scales to monitor the weight of animals
2. Supporting lab staff in bilateral text to speech communication to optimise sampling workflows
3. Sensitive and bite proof gloves to handle small rodents
4. Non-invasive animal identification

Prior to the workshop, we conducted user research interviews with five *in vivo* stakeholders, representing contract research organisations, academia, and biotech companies. These interviews were recorded, and aggregated into one video. Aiming to provide context, background, and empathy for *in vivo* stakeholders, the interview video was shown at the beginning of the UX workshop.

Four groups chose a use case each, and they ideated design solutions or created research plans that could be used for organisations looking to implement these types of projects.

The workshop highlighted the importance of including UX professionals in digital transformation initiatives. UX professionals have a wealth of techniques and methodologies at their disposal for making sense of complicated, ambiguous problems. In one instance, our participants came up with thoughtful “[How might we](#)” (HMW) questions for end users and stakeholders to ensure success in implementing these use cases. Figure 2 shows the HMW questions for the first case study (weighing animals). By asking the right questions and engaging end users, organisations can realise insights while simultaneously engaging with employees and getting crucial buy-in on their digital transformation initiatives.



Figure 2: Research questions posited by user experience professionals

Moving closer to the future

While it can be fun to brainstorm virtual surgeries and digital biomarkers using VR goggles or robotic assistants that bring test articles and compounds across a quarter mile facility, for many organisations, these goals are too far-reaching. Through direct user engagement, our team discovered that our *in vivo* stakeholders desire a more tangible future: a new data ecosystem, one where data collection is automated, studies are repeatable, and operational processes are more efficient. The “Lab of Tomorrow”, which may only address manual data drudgery, can be more attainable for many organisations, and provides the benefit of opening up the next step in the transformation process.

For organisations spending time and money on LOTF initiatives, conducting user research can be an [invaluable first step](#) in any project, and it should be repeated at every stage of the digital journey, **as a continuous process**. Before thrusting people into a new ecosystem, end users should be interviewed and engaged. This will determine the data maturity level for individual stakeholders, teams, projects, and organisations. The futuristic view of LOTF, such as digital screens, robots, and artificial intelligence, is absolutely possible, but we must walk before we run. By ensuring success at each step of the data maturity journey, organisations may have better success at realising a digitally transformed organisation, the future utopia we are all aiming for.

Conclusion

While it might be tempting to leapfrog into the Lab of the Future through digitalisation initiatives, changes that affect all systems and processes at once can be difficult to manage. Rather than a big bang approach, stakeholders should focus on the Lab of Tomorrow by taking slow and steady steps, ensuring frequent user engagement to avoid surprises. Organisations can avoid the chaos and disruption brought on by a *Lord of the Flies* style approach to digitalisation. Instead, organisations can ensure their digital ecosystems are successful by using lessons learned to make gradual improvements that have meaningful impact.

Cover Image

Image courtesy of University of St Andrews Library and University of Liverpool

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