

Making Sense of the Chaos

From Data Mining to Data Meaning

A Philips Design introduction to data



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Abstract

In this paper, we discuss the advent of Big Data, the opportunities it brings for both businesses and consumers, and how Philips Design is innovating with data to find new insights and bring value and meaning to people. Using our understanding of how our world is affected by contemporary, emerging, and future economic and social changes, we explore the ways in which data has the power and potential to transform the way we all live and work. As part of our journey, we reveal how Philips Design is beginning to co-create in new and exciting ways thanks to its data visualization group, through digital innovation consulting, and at workshops in which enthusiasts from all walks of life come together to identify and develop new value and meaning for people.

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Introduction

Data is the new natural resource. Media pundits, scientists, and futurists the world over are hailing the information gathered by connected devices as more important to this century than oil was to the 20th century¹. Just as crude can be used to make anything from plastics to petrol, so data has the potential to fuel global economies. By bringing us potentially limitless information about ourselves, our communities, and our world, data promises to transform the way we live and work.

But as the analogy (which is now well known in the data world) implies, it needs to be refined to give it meaning and value. Raw data on its own is nothing but a senseless bunch of numbers, letters, or words. And as anyone who has tried to read through spreadsheets of thousands of figures will know, it can be tiring and confusing. For consumers and companies lacking the know-how to interpret that data, this can become a source of anxiety too, as they struggle to keep up with the latest changes in the world.

The trouble is, this is where the similarity to oil ends. Unlike most natural resources, data is not finite. Quite the opposite. It is growing exponentially. By 2015, network solutions provider Cisco predicts that 25 billion devices will be connected to the internet, double the figure from 2010². By 2020, that number will reach some 50 billion, more than six times the global population. That is the equivalent of 4.8 zettabytes per year by 2015 alone, or more than 4GB of data traffic from each connected person every single day³.

Given the staggering size of this new resource — dubbed 'Big Data' for obvious reasons — it is perhaps not surprising that the debate on how to deal with it has mostly focused on technical issues. How to collect and store the information is a mammoth task in itself. From there to computing and analyzing that information has required other giant leaps forward in server technology to allow people to store, interconnect, and start analyzing complex data sets, otherwise known as 'data mining'.

But the biggest revenue streams will not come purely from technical solutions. Instead, the key to making dollars out of data lies in finding the insights among the chaos and white noise by moving from data mining to data meaning. Companies which manage to turn complex data into seemingly simple services and platforms that make sense to people — improving their relationships, health, happiness, and connection to the world — will create strong bonds and enduring connections to their customers.

These new propositions can take many forms. They can be connected physical devices like cars and home appliances, or digital solutions such as social platforms on the internet, and moreover complex ecosystems consisting of both physical and digital components. But they will all be constantly evolving. Just as humans change and adapt, so the meaning of the data they produce shifts over time. To adapt in their turn, companies wishing to be part of the data revolution need to move from creating fire-and-forget products, and adopt a launch-and-learn approach to data-driven propositions. The bigger the digital component in the connected proposition, the bigger the ability to adapt the proposition while it is used by the end user.

Designing these complex propositions requires a co-creative mindset. Companies need to shed their protective silos and open themselves up to a multidisciplinary way of working. Innovating with a broad range of specialists — from scientists and economists to people researchers and psychologists, not to mention other companies — will increase their chances of success. Through co-creating, they will find new pathways to the most compelling propositions, which will evolve organically under the guidance of the people that bring them to life, as well as the people that use them.

The New Rules of Big Data

The data world is still very much in its infancy. The debate about exactly what it is, where it is going, and how everyone will get there has just begun. But what is clear is that businesses of all sizes and across all industries will have to rethink their place within it. *It is a world that is smarter and faster, where the distinction between the digital and physical, and the company and the customer, are all blurred, and in which everyone and everything⁴ is a part of the puzzle.*

With a new world comes new rules. Any individual or company wishing to innovate within it needs to understand the characteristics of Big Data, how it is analyzed, and how it affects people and businesses in order to innovate to the best of their abilities. Without bearing these things in mind, they risk creating meaningless services, and in the worst-case scenario, alienating and losing customers or partners.

Where does it come from?

Big Data comes from any connected digital device and their interfaces, such as websites, sensors, apps, and points of purchase in retail. However, the driving force behind the new phenomenon has come from mobile devices, and in particular smartphones, which collect data on the move and send it to the internet. This data can be anything from the explicit information that people input directly, for example, in the form of status updates on social networks, web search terms, new photos, or blogs, to implicit data, collected indirectly when people turn on mobile phones, for example, activating GPS systems that track where they go. Both types of data can be analyzed separately, together, or in combination with new data sets to create new meaning.

Where does it go to?

Of course, the data does not magically transform itself into meaningful information. First, it has to be collected then interpreted by real people - the 'data miners' if you will. Today, these people are either professional data scientists and programmers, or, increasingly, enthusiasts who work together in online platforms to produce code to automate the data processing. Often, these people have day jobs in other fields, and choose to spend their evenings playing with data sets to find new insights from data that they find in open source platforms on the internet. In order to make sharing and collaboration as easy as possible, they use standardized data formats such as RSS, HTML and RDF.

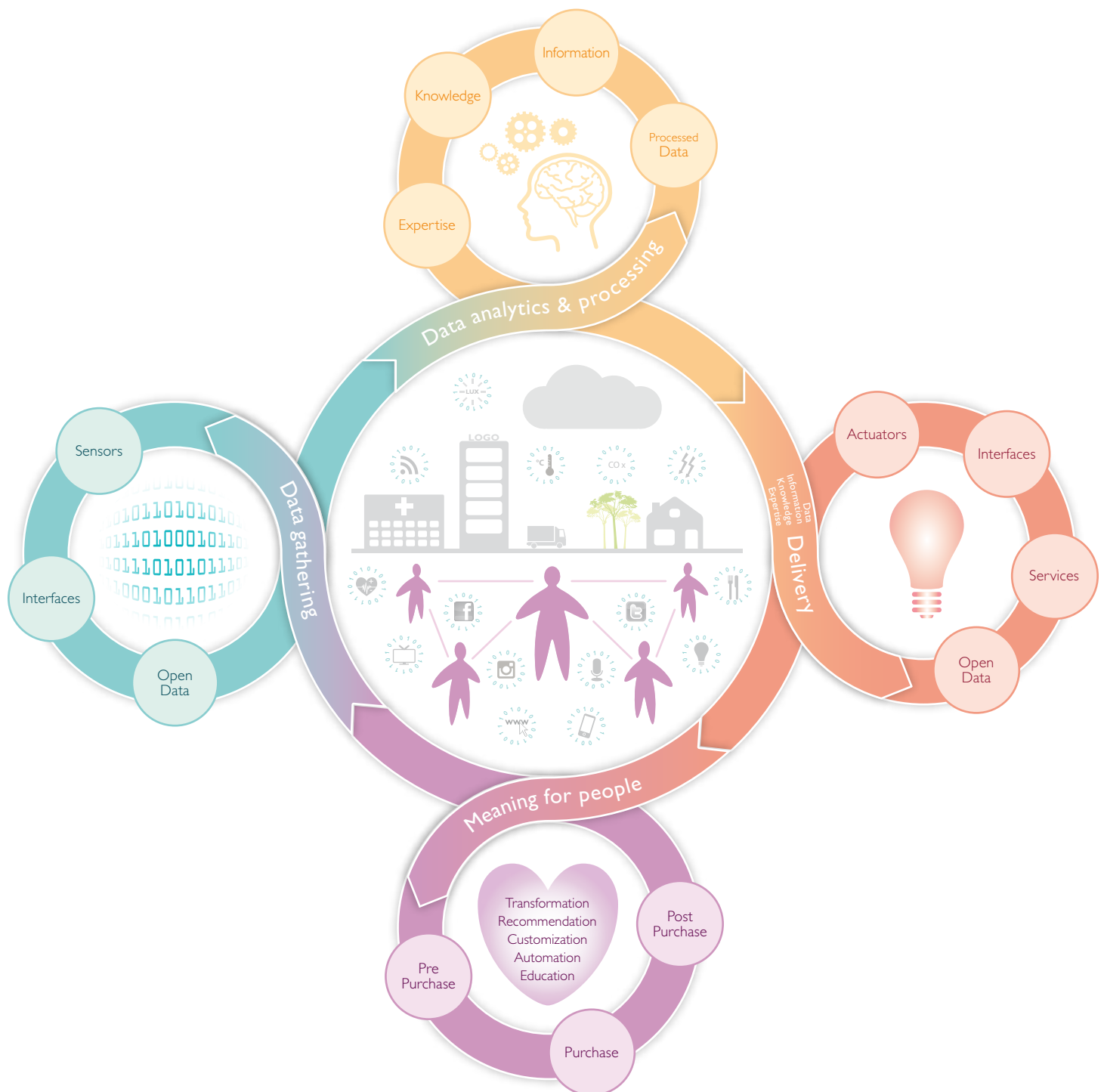
These coders then use what is known as the Semantic Web to share their work with the world and find new relationships between data sets. Also known as Web 3.0, the [Semantic Web⁵](#) is a collaborative movement that allows more and more data to be shared on the internet in file formats that can be accessed by anyone. By using the guidelines of the Semantic web, these common formats also enable automated processes to find and interpret data. This in turn helps to enable machines to understand and respond to complex human requests based on their meaning, like [the IBM supercomputer Watson, which recently beat human competitors at a game of Jeopardy⁶](#).

What it means for businesses

Big Data has the power to revolutionize companies. It can be used in marketing, merchandizing, operations, and supply chain management. One of its more common applications is in creating leaner and more efficient versions of existing business models. Online retailers, for example, use big data to track and gather information on consumer purchases or reviews, then use it to inform future decisions about inventory or website improvements, or provide customers with 'intelligent' recommendations on what to buy, based on their behavior in the e-commerce environment.

To start adapting, companies looking to tackle Big Data need to bear its key characteristics in mind, say market research company [Forrester Research⁷](#). These can be distilled down to the four Vs: Volume, Velocity, Variety, and Variability. In short, this means that businesses need to be able to handle huge amounts of complex and differing data sets in ways that help them make the best possible decisions (either for themselves or for their customers) incredibly quickly. This flow of information, from raw data through to meaningful solutions, is often referred to in the data world as DIKE, or Data, to Information, to Knowledge, to Expertise.

Put another way, any propositions that use Big Data need to be, for all intents and purposes, made up of virtuous circles of information. They need to capture and make sense of the flow of information around a system extremely rapidly. Data is no longer passive information but an active, ethereal material that is woven into consumer and business propositions. Data from people's actions is sensed, interpreted and responded to in real time, in personal and meaningful ways.



Figuur 1.
Data driven proposition cycle

Big Data can also be used to create entirely new business models. Two companies that have put this to good use are cell phone company Vodafone and the SatNav firm TomTom. Their joint project, [TrafficHD](#)⁸, uses data from network antennas and their connections to Vodafone handsets to allow TomTom to gather real-time information about the flow of cars on the roads, then feed that back to its entire network.

Crucially in the data world, 'data in' does not equal 'data out'. In the case of TrafficHD, the information gathered by the phone is used to inform other loops of information that are continuously updated and aggregated with others, to inform and improve the overall service for thousands of users.

What it means for people

For the people who use data-driven products and services, the benefits are almost limitless. The way in which vast quantities of information can be distilled into meaningful innovations can range from helping an individual carry out a seemingly simple task (automation), to insights that can radically improve the health and well-being of societies (transformation).

One meaningful way to use data is in the automation of simple tasks. For example [Nest](#)⁹ is an automated thermostat that learns from your behavior and how your house is effectively heated. It uses data from a range of sources including a motion sensor, a temperature sensor, a humidity sensor and via its wi-fi connection, online weather data, in order to program itself with the aim of saving on heating and cooling bills.

Data can also be used to customize and personalize propositions, a good example here is the portfolio of products that can be personalized by 3D printing firm [Shapeways](#)¹⁰. With simple design tools and automated algorithms it enables users to create custom 3D-printable hardware. There is still a high 'gadget/fashion' factor to this at the moment, but it is easy to imagine the wealth of opportunities that emerge from the advancements of 3D printing capabilities.

In the field of health and wellbeing, Big Data is already allowing patients to collaborate with one another. Using innovations like [Patientslikeme](#)¹¹, which encourages openness and the sharing of experiences, people can compare specific insights about their genetic predisposition, history, and lifestyle to help patient groups to learn from each other and improve their overall wellbeing. Beyond the individual, data can be used to meaningfully inform an organization. [The WeatherActive system](#)¹², for example, is used by some hospitals for decision support during extreme weather events like hurricanes.

Openness and transparency for everyone

One of the defining characteristics of the data world is openness and transparency. Before the days of the internet, companies and individuals fiercely protected their business data and personal information. Sharing data with anyone else was akin to losing their competitive advantage.

Today, although companies often still closely guard their most recent and precious data sets, many are willing to share a lot of their data. This brings two potential benefits; the opportunity to improve business through others, and for it to be applied for social interests. For example companies are increasingly partnering up to tackle environmental issues like deforestation and climate change, such as [the Planetary Skin Institute](#)¹³. This non-profit collaboration between NASA and Cisco uses data from millions of satellite, airborne, sea- and land-based sensors to analyze changing environmental conditions around the world. Besides, companies increasingly understand that by sharing parts of their data-sets they enable others to innovate and therefore extend their propositions. For example, Google Maps open APIs allow developers to superimpose data and interfaces on Google Maps.

Alongside private companies, data is also being made more accessible through [government-funded open data initiatives](#)¹⁴, and [coder-friendly open APIs, which allow third-party programmers to add new behaviors to existing systems](#)¹⁵.

Users are becoming more open and transparent too. Social platforms like Twitter, Facebook, and LinkedIn let people share data in ways akin to real-world social interactions. With the increasing uptake of smartphones, consumers can use these platforms even more dynamically to update their activities and search for new information on the move. For example, a comment from a person about his local weather or traffic is not really interesting to anyone but that person. But a comment that is geo-tagged using GPS through a smartphone suddenly becomes interesting to anyone in his or her area.

In the non-profit world, websites like [Ushahidi](#)¹⁶ are helping people in Kenya to find other like-minded social activists by enabling users to upload, store, and compare information about important local events. The site, whose name means 'witness' in Swahili, started in the aftermath of Kenya's 2007 presidential election to collect eyewitness reports of violence and add them to a Google map.

Innovating in the Data World

In the face of so many new and challenging parameters, companies are finding that they have to rethink the way they innovate. Some are noticing that their traditional methodologies cannot be easily applied to the data world. This may be because they fail to allow for the rapid evolution of design ideas, or that they are simply too linear in their outlook. Instead, companies are now looking to use fresh methodologies to find new patterns and value from data.

Data visualization

One of the key characteristics of Big Data is its sheer size and scope. As we have already seen, raw data, like crude oil, is unusable. It needs to be refined or analyzed to find meaning in the chaos.

One way to do so is through data visualization. Human beings are programmed to understand visual information much better than words or numbers. So one way for data scientists and enthusiasts to make the patterns they find in the data more understandable to others is by turning that complex data into visual patterns. The visualization of data in its simplest form can be a graph, or abstract icons that represent assets. The data can also be mapped over time, like the beautifully gossamer images created by American digital media artist Aaron Koblin that represent air traffic over the US during the course of several hours¹⁷.

A key characteristic of data visualization is that it is interactive. The visualization gives people the ability to navigate and manipulate data sets using controls to generate a visual response, like the [Data Tracer by Google's Web Lab, which traces physical routes across the globe to find where images are stored](#)¹⁸. Such playful environments allow data to be tuned to the particular interests and needs of individuals.

Mashups

As the name suggests, mashups are at the cutting edge of Big Data processing. Just like in music, where two original songs can be combined to create a new tune, data mashups are web pages or applications that use and combine data from two or more sources to create new services. Anyone from data scientists to enthusiastic individuals with a bit of know-how can use raw data from either private or open sources to create a new mashup. Using web applications to manipulate the data, they identify relationships between streams that were not previously apparent.

One such enthusiast was American Bill Davenhall, who had a heart attack in 2001. As he was lying in the hospital recovering from the operation that saved his life, he felt completely in the dark about why it could have happened to him and in particular why his doctors had not flagged his possible condition earlier. When thinking over what factors had affected his health over the years, he soon realized that his physicians had completely overlooked any environmental influences. They never drew parallels between where he lived and how that may have affected his health.

After he returned home, Bill started compiling and combining all kinds of geo-data, from local heart-attack rates to information on toxic dumpsites, and discovered that he had lived in some of the worst areas in the US in terms of environmental health. He realized that by allowing the GPS in smartphones to track the movements of their users, he could use mashups of environmental factors to track how healthy these movements are. [Bill dubbed this 'geo-medicine' and now campaigns to persuade doctors to include this information in their diagnostic work](#)¹⁹.

Gamification

Increasingly, companies are catching on to how critical these data enthusiasts can be for their business. To tap into this growing new trend, some are using what is known as gamification to help them innovate, by making their data available on websites like [Kaggle](#)²⁰, and challenging enthusiasts from all over the world to find the best solutions to a specific problem that their own business has so far been unable to solve.

Unlike mashups, gamification is typified by components such as achievement scores, challenges between groups, and cash prizes to motivate them. It encourages experimentation guided with early feedback from the business and promotes learning by doing. These are all key principles in dealing with the complexities of innovating data-driven propositions. On Kaggle, data enthusiasts ranging from (in their words) "world-class algorithm wizards" to "novices looking to learn from the best" are teaming up to solve a whole range of competitions. One such challenge, ending in spring 2013, asks participants to identify patients who will be admitted to hospital within the coming year, using historical claims data. The competition's prize money is US\$3 million, which (perhaps unsurprisingly) has attracted more than 1,300 teams.

What Next?

As we have already seen, until now, many companies have used Big Data mainly to create leaner and more efficient versions of their existing business models.

At Philips Design, beyond the optimization of our current business, we want to use data to explore entirely new propositions and territories. We are building upon our expertise in smart applications, our technical strengths in sensing, and our ability to deliver meaningful experiences to consumers to explore the world of Big Data.

To do so, we think that our approach to innovating in this world needs to mirror the characteristics of the world itself. That is, by being co-creative, playful, and rapid. As such, we are creatively exploring the following two routes.

Data-driven explorations

Using a similar approach to mashups, we are looking into ways of creatively combining existing data sets to find new propositions for our customers. As part of this, we are holding a series of events called hackathons, where anyone interested in finding new meaning and value in the field of data (from computer programmers and electrical engineers, to graphic designers, concept thinkers and project managers), can come together for a day or two to innovate in teams.

One of the areas Philips Design is exploring is health and well-being. For example we recently held a hackathon, entitled *Big Data Visualization Hackathon: 'Making the healthy choice in any environment'* (#pdvis). We gave participants links to a range of publicly available data sets about healthcare, such as (anonymous) vital signs data from patients and data on environmental conditions in a hospital, and then asked them to create applications using interactive visualization. Using an imaginative range of angles and techniques, the teams were able to quickly create a variety of concepts, including some real-time prototypes which could be explored further. Philips Design is developing the use of hackathons to enhance innovation ideas internally, as well as in open events with external enthusiasts.

User-driven explorations

The second route that Philips Design is exploring is user-driven innovations. Here, we develop innovative ways to acquire, analyze and process data sets to fulfil identified user needs, which could be automation, customization, education or transformation. For example, how to adapt a toothbrush using sensors, to detect, analyze and improve the health of its user over time. This data could also be useful to the user's dentist to provide customized solutions for them. Furthermore, aggregated data from many toothbrush users could be used to improve dental care for many.

Toward a new Business Paradigm

At Philips, we believe that successful innovation in the data world depends on a thorough understanding of the business context in which the data is applied. Our world is changing rapidly. We have already discussed how it is advancing technologically. But the world is also changing ecologically. Our global population is growing and aging faster than ever before, which in turn means we all face a future where vital resources, such as food, water, energy and healthcare, may be limited.

We believe this is beginning to affect how consumers behave. A recent paper by Philips designers Brand and Rocchi entitled '[Rethinking value in a changing landscape](#)'²¹ describes how, as socio-cultural forces change, people's perception of what constitutes value changes too. It summarizes the four economic paradigms that the authors believe describe the western world since the 1950s, and how each has or will affect both businesses and customers.

The Industrial and Experience economies are well established. In the first, which started in the 1950s, people strove to modernize their lives by purchasing mass-produced products that fulfilled functional needs, and automated many aspects of their daily lives. But by the Experience economy, beginning in the 1980s, these products had become so commoditized as to erode their perceived value among consumers. So instead, businesses used branding to differentiate themselves, by tapping into emotional triggers to make them more liked or respected than the competition.

By the turn of the century, the sheer number and presence of brands clamoring for attention made consumers increasingly numb to their messages. With the advent of the internet, people are less dependent on lifestyle brands to shape their lives, and are turning instead to online communities. These communities allow people to express their own identities and offer a new sense of belonging. Originally these communities came together on non-branded, open platforms such as USENET. Under the new Knowledge economy, companies created value for consumers by giving them very usable, social platforms, like Facebook and LinkedIn. Just as with lifestyle brands, the successful platform brands are those that create meaningful propositions for people and are trusted by them. Trust is gained by being transparent and appropriate with the aggregation and utilization of people's data.

But even as this Knowledge economy is unfolding, we see the shoots of the new Transformation economy sprouting. The negative side effects of the previous three paradigms, which include pollution, climate change, wealth disparity, and poor labor conditions, are leading to growing public discomfort. Meanwhile, as we have already seen, many social and environmental issues are growing in magnitude, such as resource depletion and an aging society, which are affecting people in both developed and developing economies. All of this is encouraging consumers to start seeking out products and services that are ethically produced and that help us to move toward a sustainable world.

Both the Industrial and the Experience economies are characterized by linear models of development and delivery. There has been a continuous ambition to optimize the linear models in the need to find ever more value. It has been realized that there are limits to the optimization of these models if the wider context is not taken into consideration. In the Knowledge and the Transformation economy we see the emergence of new, more circular models, that include continuous feedback loops with the stakeholders in their context. Digital interconnectivity and data is what enables and informs these loops.

How can data help?

In the Transformation economy, the value that companies bring comes from being part of a public-private network or community whose aim is to improve people's lives in a sustainable way, either on a global or local scale. We believe that the solutions to the big issues facing our global society cannot be found by one single player. Instead, industries, governments, academia, and grass roots movements will have to collaborate to create local solutions that then contribute to the larger whole.

With the advent of Web 3.0, many of the networks that can help bring about the transformation economy are driven by Big Data. We have already seen how the Planetary Skin Institute tracks changing environmental conditions around the world. But it also collaborates with research and development partners across multiple sectors both locally and globally to develop scalable solutions to address resource scarcity. The Institute is currently exploring a variety of such projects, including improvements in the resilience of low-income communities, early warning systems for natural disasters, and systems to support food security and agricultural risk using remote sensing and geospatial data mining.

On a smaller scale, an outfit in Chile is helping farmers to plan their work thanks to cell phone updates. [The Mobile Information Project \(MIP\)](#)²² uses software to create news feeds that give them targeted agricultural information from the internet. One farmer reported that his entire year's crop was saved by an SMS that advised him to delay planting because of impending bad weather. The next week brought a heavy storm that would have washed his seedlings away.

By being data-driven, these propositions continuously adapt to the user and their changing context to ensure that the information they provide is up to date and meaningful. The bigger the connected digital component of the proposition, the bigger the meaning that can be derived from it, and ultimately, the bigger the number of people whose lives can be improved by it.

Changing mindset

For the moment, organizations like the Planetary Skin Institute and MIP are the exception, not the rule. While society may be moving slowly toward a new era, many companies find they have trouble letting go of old practices and mindsets.

To help businesses, organizations, and even individuals innovate for the transformative economy, Philips Design believes that the two strategies we are currently exploring can help. By bringing groups from a wide variety of specialties and backgrounds together, for example, in hackathons and gamification workshops, we will be part of the new data-driven world. It is a world in which digital innovations bring people closer together, to make sense of the chaos and bring real meaning to all of our lives.

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About Philips Design

Philips Design is one of the longest-established design organizations of its kind in the world. Its creative force of some 400 professionals representing more than 35 different nationalities, embraces disciplines as diverse as psychology, cultural sociology, anthropology and trend research in addition to the more 'conventional' design-related skills. The mission of these professionals is to create solutions that satisfy people's needs, empower them and make them happier, all of this without destroying the world in which we live.

