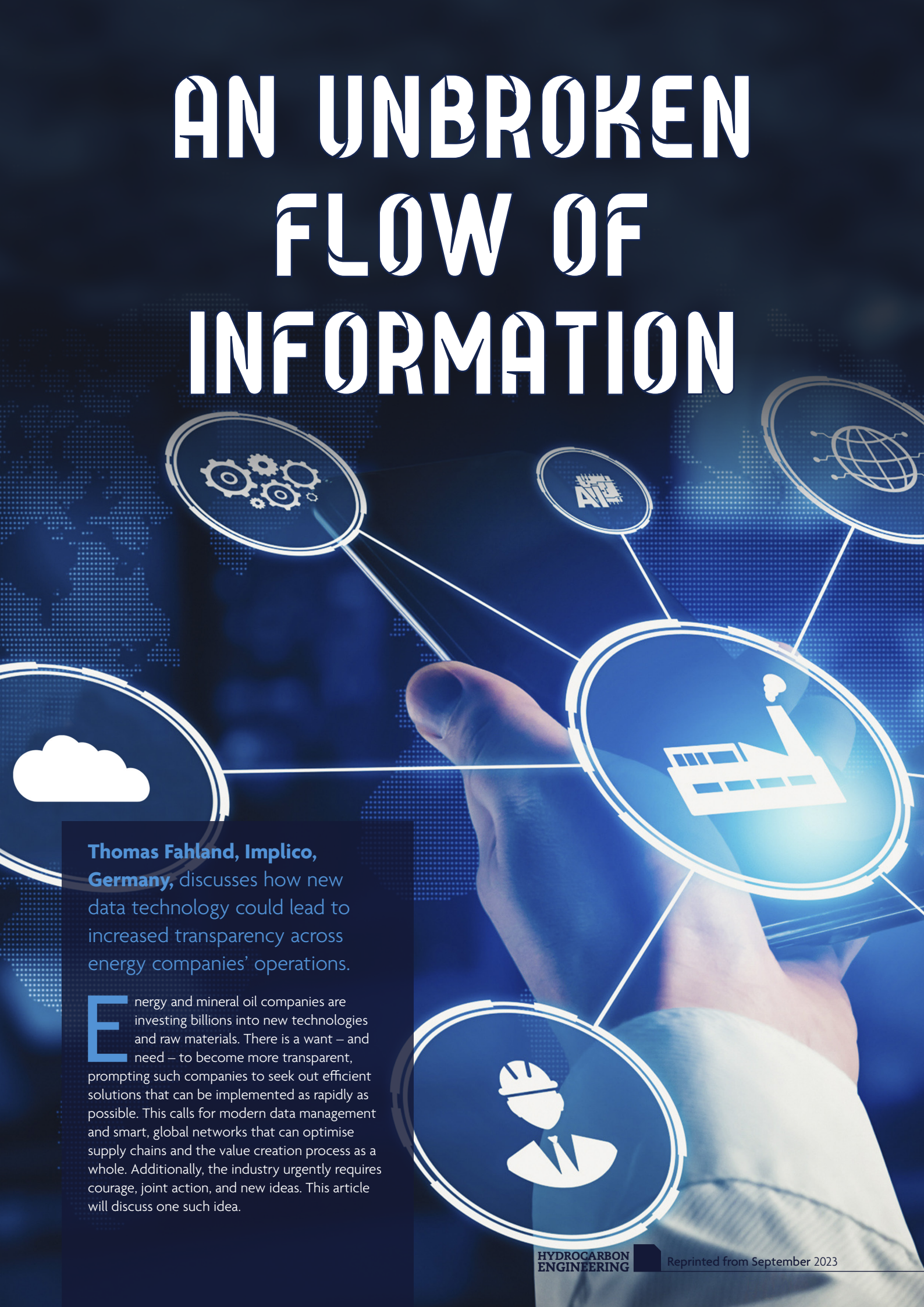
AN UNBROKEN FLOW OF INFORMATION



Thomas Fahland, Implico, Germany, discusses how new data technology could lead to increased transparency across energy companies' operations.

Energy and mineral oil companies are investing billions into new technologies and raw materials. There is a want – and need – to become more transparent, prompting such companies to seek out efficient solutions that can be implemented as rapidly as possible. This calls for modern data management and smart, global networks that can optimise supply chains and the value creation process as a whole. Additionally, the industry urgently requires courage, joint action, and new ideas. This article will discuss one such idea.

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Intelligent technologies can assist with efficient process management, forecasting, and transparency. Examples of these type of technologies include data analysis, blockchain, digital supply chain management, and artificial intelligence (AI). There is a great deal of hope surrounding the data that is identified, collected, measured, analysed and compared on a day-to-day basis. Too often, though, the use of these digital tools remains confined to the bounds of a company and its systems. This did not pose a problem while the industry was still dominated by the major mineral oil players, i.e., those that oversaw virtually all of the steps relevant to production and the supply chain – from crude oil production, to refinement, to service station delivery. However, the addition of far more stakeholders, resulting in market diversification and greater public interest towards the energy industry due to the current climate discourse, and the resulting energy transition, means that data processing needs to be thought about in a new way.

A number of developments are currently underway, a major one being the recent drafting of the EU Supply Chain Act by EU Parliament. Under this law, companies with 250+ employees and a turnover of €40+ million will have to be much stricter when monitoring their entire upstream supply chain, all the way through to the raw materials that they use. The provisions set out by the law are far more stringent than many national regulations that are already in place (such as in Germany). Additionally, companies whose headquarters are located outside the EU will need to comply with the Supply Chain Act if they earn at least €40 million in revenue within the EU. All stakeholders within the supply chain need to uphold certain standards in terms of sales, distribution, storage, transportation and disposal. Even though the EU Parliament still needs to formally inform the EU Council, it is expected that the law will enter into force at the end of 2023, thus creating various short-term, complex tasks for companies to take care of. These need to be monitored and accounted for.

The importance of traceability

When it comes to product information that cannot be measured, full traceability is becoming increasingly important – and not just due to this new law. The following all play a role: geopolitically-determined sanctions; carbon dioxide (CO_2) emissions trading; subsidies for renewable products; quality requirements; EU sustainability ordinances; and complex classification and processing of customs and energy tax requirements. If a company manufactures its products or procures raw materials abroad, it will need to know which partners it is dealing with, and be able to document this.

Full traceability of products and raw materials; monitoring that covers all stages of production, refinement and distribution; and information about every stakeholder in the global supply chain will either be requested or required. The following questions may be asked: where does the crude oil in tank farms and refineries come from? Which raw materials can be found in the diesel that is sold to specific service stations? How high is the share of crude oil from certain states at the Port of Hamburg? It is essential to be able to provide all relevant information regarding origin, suppliers, share of renewable energy sources incorporated into the product, working conditions, wages, transportation, customs duties, and more.

In the near future, consumers, public authorities, investors and other stakeholders will all expect industry players to have ethically-spotless sustainability profiles, transparent supply chains, and comprehensive product information that they can make available as required. This stands to have a significant influence on the energy sector and the mineral oil and petrochemical industry, given that these industries are viewed with greater scepticism than others due to the increasingly rapid pace of the energy transition and the tremendous impact that this has on global politics. The entire industry will be affected by these new requirements. Even terminal managers and other service providers in the supply chain will have to adapt their facilities, parts of their infrastructure and various services to these provisions, and offer the required level of support in order to stay on top of things.

The question is: how can traceability be ensured for the entire history of a liquid or gas product? How can we look at the final product and understand where, when, by whom and with what it was produced and distributed? This is difficult enough with standard consumer goods such as clothing; however in the clothing industry it is possible to use physical labels, imprints, embossing, etc, for traceability purposes. This is not the same for refined oil and gas products. The complexity is further compounded by the fact that knowledge about supply chains is frequently confined to information disclosed by suppliers and data found in Excel tables. As we move into the future, this will no longer be sufficient. In particular, all relevant data, figures and information will need to be made available in near real-time.

What is needed, first and foremost, is end-to-end validation of raw materials across the current IT solutions landscape to ensure transparent, sustainable raw materials management. It is important to consider that, while this branch does have communication standards for parts of the process chain – such as the PIDX/CIDX data format employed by more than 120 oil and gas companies – these 'standards' can neither be applied across processes nor used properly by the majority of participants in the supply chain. Additionally, the focus is often placed on customer-specific, modified point-to-point data communication that falls short of meeting modern requirements – unlike, say, real-time networking with an API interface.

Oil and gas companies need to be more agile and open, and quicker. There needs to be a move away from proprietary solutions and silo mentalities, towards cross-company data usage in global process chains – with better interlinking of data, open interfaces, and new data sources. Paperwork and folders need to be eschewed in favour of 21st century technologies that facilitate the secure provision of data across various stages of the supply chain and guarantee consistent data and information flows that are always up to date.

Even more importantly, a meta level for information that can no longer be removed from the physical product through methods of analysis or measurement is also needed.

This level should be independent of the 'measurable' world of product flows (how much of which product was transferred from A to B and when?) as mapped out by current systems and communication chains – at least in part. A meta level can provide information about the entire history of the product, how it was produced and any changes that have been made, etc., answering the following questions:

- Where did the basic components come from?
- Which technologies and energy sources were used to refine it?
- What was added to it?
- Which types of certification does it hold?
- What is its CO_2 emission factor?
- Who had a hand in production and delivery?
- Have customs duties and energy taxes already been paid on the product?

Instead of working on individual solutions, all actors in the supply chain should nourish this meta level with the required information. This would pave the way for the product's full traceability, transparency and, ultimately, an intelligent platform on which all subsequent processes can be implemented. Only through this will the aforementioned challenges be combatted.

Biotagging: no longer the realm of science fiction

For argument's sake, this article will assume that every molecule in the extracted crude oil and in all components added to it during subsequent processing has its own clear signature that contains all information of relevance: physical properties, current location, customs status, CO_2 emissions values, actual owner(s), etc. Every participant in the supply chain can access the data that they need and change it, correct it, supplement it, and so on. The information can be accessed by owners, customs officers, transporters and hazardous materials authorities, as well as other stakeholders who have an interest in receiving all of the information about the product and, last but not least, the end customer, who can fill up their car with a clear conscience.

There are already some available technologies that allow for the addition of biological or chemical substances that do not negatively affect a product's properties. These are used as 'molecular vessels' in which all relevant information is saved, and which are produced and transported based on the DNA of the product in question. This technology functions as an invisible, non-manipulable pigment that is a messenger for relevant information and that can be sorted and interpreted by computers or special machines.

Furthermore, biotagging offers more than just a guarantee for the purity of the product. It can also be used to provide proof of origin and transfer information. In fact, it appears that there are no limits as to how biotagging could be used.

Digital alternatives that allow for this meta level to be created do exist, one of which is blockchain technology. Familiar to many thanks to cryptocurrencies, blockchain is a pure peer-to-peer network with no superordinate service providers. All information is stored in blocks, which are copied any number of times and stored on individual computers. If someone in the chain adds or removes data, this changes the information in all of the other blocks. Every actor in the digital network sees and processes the same data, and every amendment is automatically relayed to the other blocks in the chain. Encryption and distribution mean that data in a blockchain cannot be manipulated. Additionally, blockchains can be programmed to automatically trigger events and payments when certain conditions are met. They allow for the secure custodianship of highly-sensitive data and information, while individual actors can only access the information that they actually need.

However, introducing blockchain technology to a strongly diversified environment with many participants and innumerable IT systems is far too complex, time-consuming and expensive as a first step. Solutions to many of the aforementioned challenges can be found in the gradual refinement of existing IT applications and the often proprietary point-to-point integration of individual participants in the supply chain. As an example of this change, Implico has set its sights on using cloud services to track product metadata, starting with neuralgic points in the supply chain, i.e., refinery production, import and customs duties, tank mixing, and taxation.

By using these technologies, essential information can be provided, eliminating the gaps that continue to plague the supply chain today. This is the case in refinery production, for example – a process that transforms crude oil into a number of different end products, each with their own unique properties (diesel, benzine, bitumen, etc).

Although a traditional mass balance can provide information about the relationship between the respective materials used and produced, this leads to the creation of products that have a physically and chemically different composition. The manufacturing process (as well as the type and volume of energy consumed) also shapes the complex requirements that arise in its wake, whether in terms of taxation, within the framework of the EU's CO_2 emissions trading system, or the like.

Ultimately, it will be important to know the type of energy used to power these refineries in order to determine their CO_2 emission factors, and those of the end products. Other examples include imports into the EU, customs, the mixing of products in tank farms, changes to the physical state of the product (e.g., LNG), types of packaging and, depending on the situation, multiple changes of ownership. In the future, the required information will be available at the meta level for all of these critical areas.

Once cooperation between all participants from a digital perspective is ensured, steps can be taken towards a future that is easier to shape, thanks to this new transparency. Priorities should be to build bridges, close gaps, and propose new approaches.