The next generation of data capturing
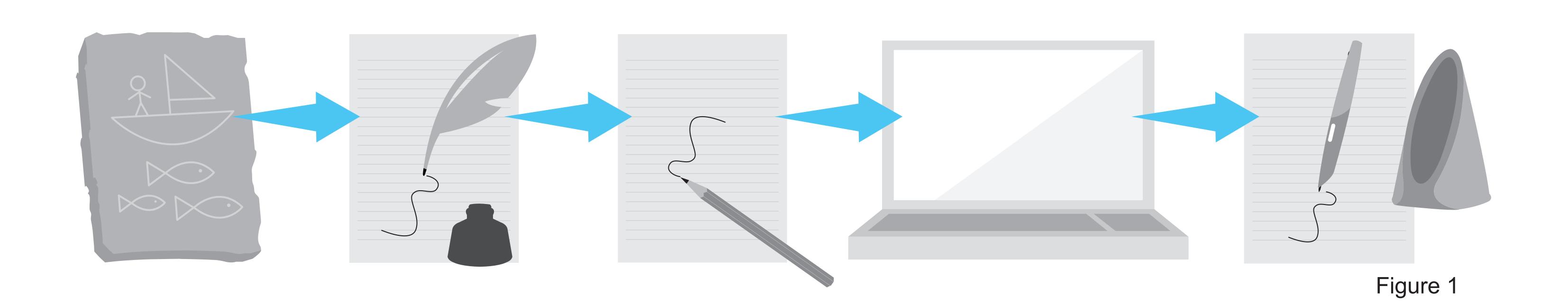## *digital ink* for the data stewards of the future

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Motivation

The realization of persistent information started approx. 37000 years ago in the days of cave paintings (Fig. 1). In the following history stone tablets (eg. sPad) were used to record information first and then a steady development of persistent information from „paper and ink feather", „paper and printing techniques" to „computer-based information recording" happened. Until „computer-based information recording", the paper-based recording was the choice throughout the last centuries.

In many scientific disciplines paper-based recording remained the only option over the last decades. These data and informations need to be converted to a digital representation for further „computer-based" use. After these manual and error-prone transformations the information can be analyzed and interpreted in the context of scientific research.

Figure 1

Data stewardship of the future requires the evolution from an expert driven discipline into a general scientific routine.

The Kiel Data Management (KDM) Infrastructure places data capturing straight in the data creation process. With this approach student education courses can be just another use case of data capturing. Smoothing this process and usage of available technologies inspired the KDM Team to prototype with „Smart Pen" and *digital Ink*.

This technology with handwriting recognition fills the gap between the very long-lasting paper protocols and their manual digitalization of field and sampling data. The combination of the KDM Infrastructure with the *digital Ink* technology enables data capturing from student education throughout high-end scientific lab work.
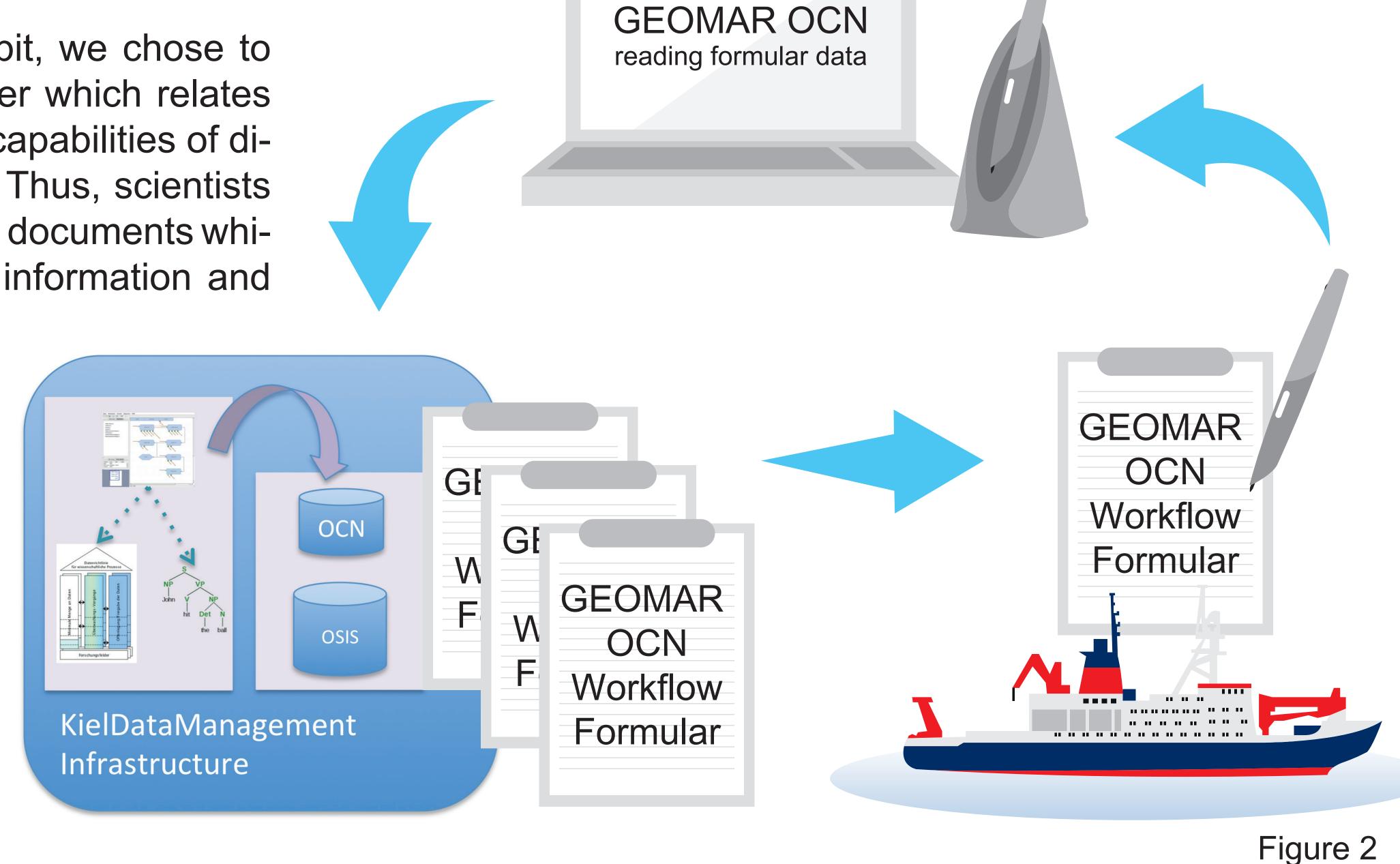
Solution on KDMI

To take advantage of a scientist's habit, we chose to use familiar but special prepared paper which relates to the digital representation using the capabilities of digital pen and the *digital Ink* software. Thus, scientists can simultaneously access their written documents while having a digital realization of their information and data at hand. Smart pens and integrated software components allow lossless transfer of data and information from paper into digital content.

Its handling is easy to learn, courses and research internships are good opportunities to enhance and promote the application. Another positive effect is that during the courses and internships the collected information can be used for training data management compliance. This enhances the internships according to real world conditions.

Figure 2

Detailed look

Work processes eg. onboard a research vessel or during field work have certain structures. Logging and recording of samples follow standardized methods. The combination of these methods and structured field and lab work can be serialized into scientific worksteps and workflows.
In a structured approach such standardized procedures can be printed out on „digitally enabled" paper forms to be used in the field or in the lab. Useage of the interface to **PenVision's**

Formidable - Fully Dynamic Forms - product allows us to generate these forms automatically with our KDM infrastructure. After manual fillout of these forms the *Formidable* software connects to the KDMI interface and transfers handwritten but yet digitized text and numbers into our information system for future usage such as data analysis and archival.

Conclusion

This approach allows scientists to link the papery and digital worlds and represents a milestone towards better data stewardship. The „Smart Pen" with the *digital Ink* perfectly fills the numerous gaps between data creation and persistance in data infrastructure.

The digital representation linked to paper work even implies more safety due to - often required - redundancy on different media.
Data management teams can support data creation processes leading to an optimal data lifecycle.