There must be money in the bank

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For technical museums, the goal of preserving cultural heritage for the future—for instance, for the year 2217—is to be able to reconstruct all products and their means of production in 2018. Although optimistic, that goal can act as a guiding principle for the work of technical museums. Of course, such collections can maintain only a fraction of all possible artefacts, typically selected for their quality and representativeness.

However, recent achievements of that goal have been severely impaired for several reasons. For one, technical museums in many countries currently do not prioritise collections compared to other tasks such as communication, and many museums collect far fewer items and information than they did 20 years ago. From another angle, if we analogise museums to banks, then more funds are being withdrawn than deposited, and, in time, the bank goes bankrupt.

Although this paper describes the situation of technical museums in Denmark, their development has been largely similar to other such museums the world over, partly due to the condition of their cultural departments and partly because accommodating trends of post-industrial society has become a major challenge for technical museums.

The disappearing narrative

History has always been a narrative of changes. Although the changes that history records have occurred for as long as humanity has existed, they have usually materialised gradually throughout extended periods. For example, whether born in the year 800 or 1400, a person would have had nearly the same options for transportation—that is, on horseback or by wind-powered boats. With industrialisation, however, new modes of transportation emerged. A person born in 1840 would have been able to migrate also by rail and steamship, and by 1900, travelling time would have greatly decreased and possible distances greatly increased. By the mid-20th century, people became able to travel around the world relatively quickly and easily by airplane or, for shorter distances, by car.

At the same time, industrialised mass production has made products cheap and provided new opportunities for products by using components and chemical substances in new combinations. Briefly, production operates in a market in which competition pushes players to continually develop better products. That market mechanism has long persisted, even if pressure for such changes has altered over time. In recent decades, the rate of change has become unusually rapid. As products become cheaper, they also become more expendable and, with new models, replaceable. Today's culture of consumption and waste has influenced and been influenced by the characteristics of most products. For example, very few consumers now use smartphones more than 10 years old.

A million different products

Industries for mass production have also changed in recent decades. A century ago, large factories often produced many different products for a local market. However, with the increase in global trade, a single factory became able to supply the entire world, and in time, the trend has allowed specialised production in which a single factory produces only a few different products of high quality at low cost. Moreover, today's international distribution system distributes those goods to nearly uniform businesses worldwide.

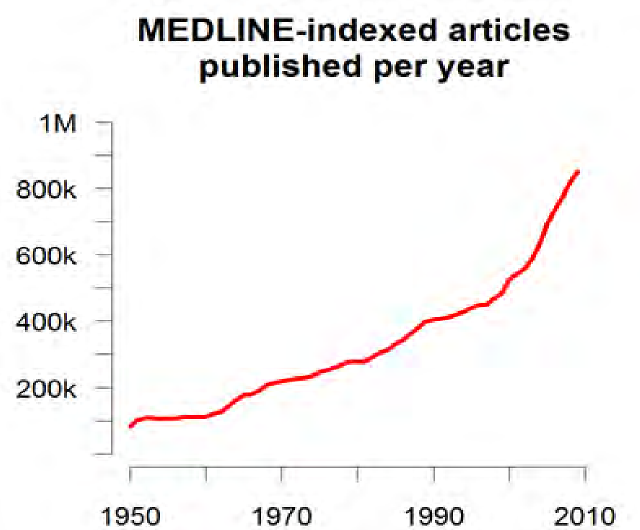
Thus, a large supermarket in a wealthier part of the world can supply more than 100,000 different items. Although some of the products are the same yet packaged in different quantities, many products nevertheless remain that today's museums have to be able to review and select from. In more specialised areas, the possible range of products includes several types. A pharmacy, for instance, typically offers 10,000 different products, and a supplier of tools for the plumbing sector can offer as many as 350,000 units. On top of that, many other industries have their own unique products as well. Although an inventory of the number of current product types remains unavailable, the number is likely far greater than 1 million.

Rapid change

The array of products is responsible for only some problems at today's museums, whose list of tasks includes preserving knowledge about production. A host of different products are often manufactured at a host of different factories, which, in the current era of mass production, are often so specialised that they may manufacture only a single component. Once that component becomes obsolete, however, so does the factory. Although some factory buildings can be re-purposed for other means of production, most workshops, laboratories and production facilities are ultimately demolished. As a case in point, giant factories have been constructed to produce electronic components expected to be useful for only a few years. Samsung's factory that produces fourth-generation 3D V-NAND flash memory chips in 64 layers is a good example. Built in Pyeongtaek, South Korea, and commencing production in 2017, the factory makes small 256-GB solid-state drive (SSD) memory chips that will be commonly used in the next few years. The chips are both 30% faster and 30% more energy efficient than the previous generation of 48-layer chips. Because the small SSDs largely outperform traditional hard drives, manufacturing plants of heir predecessors have become outmoded and have closed. Similarly, in the coming years, a new technology will likely replace the 256-GB SSD memory chips. If technological advancement continues at the same pace—and that pace is liable to accelerate—then Samsung's plant will become outdated within 7–10 years

Growth in knowledge

At the same time, the rapid speed at which technologies change is also not the only problem for today's museums. Each specialised mode of production also requires specialised knowledge that places great demands upon museum personnel who have to be familiar with such knowledge. For example, in 1950, more than 100,000 articles addressing medicine were published, whereas nearly 70 years later, more than 1.2 million articles in the field are published each year. The scope of medical knowledge has thus increased by more than 1,000%. China and many other previously under-developed countries have supported that boom in knowledge, and their activity can partly explain the rapid acceleration in research since the mid-1990s. Whereas annual growth in research in 1950 was 1.5%, that rate in the past 10 years has more than doubled, and the increase in knowledge in other areas of science has likely occurred at the same rate. As an example, electronics giant Samsung has increased its research output by 12% or more per year.



Vast, coherent systems

The problem for museums is exacerbated also by the fact that industrial production occurs in ever-larger, more complex systems. Often, the systems have become so complicated that only a few individuals understand the connections therein. For example, most people could not explain where the electrical power in their living rooms originates or comes to power their appliances.

The team at the National Museum of Science and Technology has documented a case in point: the Stålvalseværket, a Danish steelworks. The Stålvalseværket is an industrial company that manufactures its products on three machines with the support of a range of smaller tools. By contrast, the three machines – the furnace, the rolling mills for plates and rolling mills for rods - are all gigantic, and the largest of the plateau's many rolling chairs weighed more than 600 tonnes.

Even the hidden history disappears

If we were to preserve all objects of the present as well as knowledge of their production, in 100 years we would likely have only fragments of that knowledge. Because most information is archived in digital form, only if museums continuously convert data from one system to another can the data remain readable. Although conservation systems have been developed in response to that dilemma, information risks being lost via its conversion. For example, data about computer-aided design and manufacturing systems could be lost if those systems are not fully compatible with future filing systems.

More importantly, digital data can disappear completely. In the traditional storage of data, a hard disk or SSD can suddenly stop working and its data become irrevocable. Fortunately, that problem can be avoided in the ordinary storage of information by establishing parallel data storage so that if stock should disappear, it can be re-created from a copy. However, increased data in continually more advanced chips used to control machines and tools cannot be copied, and the information is liable to suddenly disappear or the component become so unstable that the tool can no longer work.

Of course, those possibilities portend not only the destruction of the historical value of products. They often also extend to new materials that unfortunately wear down or decompose over time, as does rubber and many other chemical products. The vast array of new materials means that developing knowledge about how they can be preserved and their breakdown stopped is beyond realistic. Worse still, many materials are often assembled where waste materials from the decomposition of one material help to destroy others.

As a result, it is likely that museums 100 years from now will be unable to demonstrate how one of today's drones works. If only one of its components fails, then the drone cannot fly. Paradoxically, we will more than likely be able to show how a steam engine from 1840 worked, as well as how iron was processed and incorporated into the primitive machines of the time.

Internal problems at museums

The ability of museums to preserve technology and related knowledge has also unfortunately diminished in recent decades. Although such decline varies from museum to museum, the following description provides a reasonably general picture.

Over-crowded magazines

First, the magazines of museums are over-crowded and leave little room for the many and often large objects of today and the future. Museums have traditionally collected in concentrated amounts in their first years of activity, and as decades pass, their collection rates drop but nevertheless continue at a reasonably high level. Thus, whereas new museums do not experience that problem, the magazines of 100-year-old museums are well stocked, if not nearly saturated.

Although the problem of over-crowded magazines affects all types of museums, tech museums particularly face problems on that account, because their objects are often of considerable size. However, it is possible to counteract or delay the problem by way of selective disposal. Danish museums, for instance, have begun to pursue coordinated disposal; they have their collections in a common database, and by comparing the items, they can identify copies and discard the physically worst artefact or the artefact with the weakest provenance. Although only a small percentage of museum objects have actually been discarded, possibly half of the magazines can be freed by an effective, albeit costly, process of comparing data. In any case, however, such measures can only postpone the overriding problem that there will always be growth in the conservation of physical objects and, consequently, that access must be limited.

Clearly, museums have to respond to such diminished awareness, which often happens by means of offensive measures involving improved dissemination. Nevertheless, it is difficult to compete with widespread commercial productions on the Discovery Channel and SCI and the many historical pictures on Pinterest.

That altered priority, however, helps to tip the balance of the internal lives of museums, where research is conducted and collected less as internal resources are channelled to dissemination necessary to maintain the attention of museums.

Less public support

Signs of weakened support and attention to technical museums also unfortunately abound. In certain circles, interest in technology remains high, although in broad segments of the population, technological development is no longer fascinating. People are aware of new products, and their outmoded counterparts are simply useless.

That trend is a consequence of the culture of consumption and waste in which the old is no longer repaired or saved. Previously, local history was strongest in areas with a geographic and perhaps family-related connection to products and factories. Such local associations have of course lessened as ownership has been outsourced or channelled into anonymous equity funds.

The products also shed their unique local connection when they consist of components and materials from foreign factories. The downward trend of public interest in history is clear. In Denmark, the state has introduced a general cut of many areas that has affected historical museums, which can save 2% per year over a set number of years; however, because museums do not have the opportunity to rationalise through mechanisation, such policy has meant staff cuts.

Responding to challenges

To continue fulfilling their task of securing industrial and cultural heritage, technical museums collectively have to respond to the mentioned challenges. At the same time, each museum needs to develop its own solutions for renewal.

However, such actions, both collectively and individually, will only begin to guide museums along an ongoing process of conversion. Technical museums need to change their strategies in two particular areas: becoming specialised and documenting the present. Although both areas are connected, I refer to them separately in what follows.

Contemporary documentation

In 1987, I helped to preserve Bruunshaab Papfabrik as a working factory. The buildings were constructed in 1909, and many of the machines from 10 years later, when the company manufactured cardboard, still work today. Schoolchildren and tourists can pay visits to observe a completely authentic factory as it worked in the 1950s. The company's production is specialised, and the sale of its niche products, together with revenue from the factory's visitors, can afford an economy that ensures the survival of the factory.

However, it will likely remain impossible to maintain a functioning factory from our present time. As mentioned earlier, it will also prove impossible to preserve many of its physical objects. As an alternative, it is necessary to document the physical artefacts. Current rapid changes described earlier also require the documentation of companies while certain forms of production are still in operation.

To reiterate, we simply cannot preserve a great deal of today's technology. The steel mill's three machines rank among such machines. Accordingly, museums need to document what is in use while it continues to be used. Doing so poses the great advantage that all players involved in the activity, who can remember the reasons and means of production during recent decades, remain available for consultation. Via internal networks at companies, researchers can familiarise themselves with everyone involved in the production at some level. Employees today still know the companies and technicians who installed the systems, the managers, the representatives of trade unions, bankers and investors and the roles that they played, what official authorities were involved and, in the case of approvals, the certification institutions. Today presents a unique opportunity to learn about all aspects of human activity that will become possible in 30 or more years. Some of the present can and should be saved, however. Digital archives have now become relatively cheap to maintain once initial setup costs are paid. As a result, organisations and institutions can store all of their technical drawings, email correspondence, minutes of meetings and much more. At the same time, the activities can be maintained in photographs and on video. Again, although the possibilities for conservation are great, it should be remembered some work other than that dedicated to actual recordings is required in registering materials.


Walker Danmark - historie 5

W1-01
Svejseafdelingen
Opslagstavle for svejsegruppen
Imidten svejseanvisninger fra kvalitetsafdelingen, th. besked for den manuelle svejsegruppe, tv. resultatskanstavlen

W1-02
Afskærmningen på svejsekabinerne
De orange gardiner skærmer for svejselyset. Diverse emballage; th. lækteste måler (ude af drift) bag ved filebænk

W1-03
Svejsekabine nr. 11
Under udluftningshætten: grønne rulleborde til opstilling af svejsefixturer.

W1-04
Svejsekabine nr. 12 (nr. 13 findes ikke!)
Emballage med dele til et lyddæmpersæt. Fixturens blå farve viser, at det er OE-produktion.
Af mærkesedlen ses, at nogle af kasserne indeholder 200 stykker.

W1-05
Svejsekabine nr. 9
Svejsning af dele. Fleksible rør til dieselbiler.
Bemærk ventilatoren - optaget i en periode med undertiden mere end 30 grader.

W1-06
"Kontor" bag ved svejsekabinerne.
Lille terminal for personalet.

My experience from contemporary documentation at the National Museum of Science and Technology shows that the resource consumption for a document of a company of 200 employees comprises two full-time equivalents of 1/3 academic staff and 2/3 for a registrar, a photographer and secretary, among other personnel. If the company is high tech, then the dual academic effort can be used to obtain an overview of the area's most important scientific background.
After documentation, it is possible to select the most important items from the company. Selection has to retain the possibility of communicating with the company at exhibitions and should focus on suitability for later research. Many companies (e.g. power plants, food companies and pharmaceutical outfits) will be unable to deliver products to preserve; their products have to be documented in alternative ways—for example, via statements from consumers.

"Standard" documentation (middle sized factory, 200 emp.)
2,000 photographs
10 hours video
30 linear meters archive
100 interviews
40 GB data archive
200 artifacts
3 months fieldwork

Contemporary documentation is problematic not only in terms of its high cost. It is also a new, difficult form of work. In a way, technical museums perform industrial espionage for the future, even if the acquired knowledge can be misused by outsiders in the future. It is therefore necessary to have a high degree of safety in the work. Technical museums will also discover major conflicts that plague all jobs, and in response, they need to promise both their chief executive officers and staff that personal information may be disclosed only under certain conditions. I have also observed problems with public authorities at all of the companies in which I have conducted contemporary documentation. The circumvention of food authority requirements and the violation of competition law could have dissolved several of those companies, just as violation of security law could have halted their production for longer periods. Information therefore needs tight conditions for publishing, and involved parties will certainly require protection periods of 50 years or more. Technical museums have to live with that inevitability, even if it means that they cannot exhibit the results of their hard work because doing so could present problems with maintaining revenues.

Contemporary documentation also presents the problem of lack of time. Museum personnel need to be critical of collections method and be exceptionally careful in selecting subjects and conditions to be examined. Museum personnel also need to take care to not only consider current situations but also ensure that their efforts can be used by people in 100 years, 200 years and even further into the future.

Funding for cultural heritage is unfortunately also tied to political desires that are often not based on academic research. Nationalism and nostalgia have fuelled a great deal of financial appropriations and will doubtless continue to do so in the future. Therefore, technical museums collectively need to convince funding bodies of the distinct necessity to perform contemporary documentation even if such necessities conflict with current political wishes.

Specialisation and internationalisation

Technical museums can no longer aim to treat all areas of technology as they could have 100 years ago. The array of industries and business types makes it entirely unrealistic for a single museum to cover fields.

Along with the increase in tech fields, knowledge in individual fields has also grown. With such a vast amount of knowledge, technical museums need to gain greater insights into the topics in order to manage their tasks. Because such profound knowledge can be achieved only in a few areas, individual museums have to become specialised if they seek to collectively treat all kinds of businesses and industries.

It is therefore necessary that the world's technical museums pursue committed international co-operation. Knowledge exchange about qualified efforts performed by technical museums needs to be far greater. It will ultimately counteract duplication and the wasted resources could be used to preserve information from other areas.

Engineering museums, for example, could establish co-operation based on industry divisions such as information technology, medicine and textiles. In that arrangement, a museum would have chief responsibility for communication among other museums working on the same subject.

Each year, their co-operation could be discussed in connection with the meeting of CIMUSET. By doing so, technical museums can effectively shift from being national to international institutions.