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TOWARDS A METHOD FOR PROFILING ENGINEERING DOCUMENTATION

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1. Introduction

Recent years have seen a lot of interest in how people use, generate, save, and search, paper and electronic documents. Boardman and Sasse (2004) examined practices in the management of personal documents in relation to the structure of email and bookmarks. They found that people employ a rich variety of strategies both within and across bookmarks, email, and file hierarchies. Barreau and Nardi (1995) compared their respective studies of computer based document filing, and cautioned against researchers assuming the prevalence of high volume filing outside of research contexts. Sellen and Harper (2002) remind us of the many important affordances of paper. Whittaker and Hirschberg (2001) discovered differences between the effectiveness of filers and pilers. Bondarenko and Janssen's (2005) study suggested there was lack of support for embedding documents in meaningful information structures; and that support should be given to regrouping documents as the task goes on. Henderson (1990) as well exploring the importance of diagrams, provided detailed evidence of mixed use of electronic and paper documents as common engineering practice. Roy et al. (2004) were concerned with documentation procedures in aero-engine development, and observed that with paper based documents there were issues with traceability and bottlenecks (caused by the need for several engineers to access a single paper document).

Our concern is to build on this and related work (e.g. Dubois 1995, Hibberd and Evatt 2004) to develop a method for profiling engineering documentation. This paper reports the empirical and theoretical work undertaken in the first iteration of such a method. We have several motivations for undertaking engineering documentation profiling, it provides data about: 1) the varieties and types of engineering documents; 2) the strengths and weakness of document manifestations; 3) the patterns of document use within different 'types' of engineering company (e.g. SME, design, manufacturing); 4) in addition it provides a basis for building an understanding of the design and manufacturing process that use and generate the documents; and 5) helps support the development of innovative document search and retrieval tools (c.f. Liu et al . 2006).

To date a broad analogy for documentation profiling is to compare two different approaches to examining a forest. On the one hand, we could count the number and types of trees, using a crude taxonomy. Another approach would be to understand not only what varieties of trees exist, but also how they grow, how they coexist with other artefacts, processes, and inhabitants of the forest. Once we have developed richer tools for describing the context and properties of engineering documents, we can move on to produce robust quantitative figures about document use that are theoretically and contextually grounded. The developing engineering documentation profiling method focuses around the documents that engineers have use and generate. This leads us to consider: 1) why documents exist; 2) what their strengths and weaknesses are; and 3) how they support engineering and manufacturing processes. We continue by discussing findings from our first case study (section 2),

and following this briefly elaborating the modelling frameworks developed out of the first iteration of our work (sections 3 and 4).

2. Case Study

2.1 Setting and Context

TrollCo is an Engineering Design and Manufacturing company based in Wiltshire, UK, with around 60 employees and a turnover of £5 million. It has both an Engineering Services Division that undertakes general engineering and manufacturing work (e.g. nuclear, railway, highways), and its Product Division that designs and manufactures their own product line. A core set of staff undertakes common tasks, such as administration, finance, quality management and the actual manufacturing of artefacts. Otherwise, the engineering services division and the product division are conceptually distinct. TrollCo has several highly qualified staff members, and there is a culture of pride in the quality of their work which can be summed in the phrase, "We are the Rolls-Royce of PRODUCT_X," heard on a number of occasions from the Engineering Director. The pressures of the market can be summed up by an adjunct quote. "Trouble is people want Rolls Royce at Ford prices." The company is also British Standards Institute (BSI) quality certified and this is seen as a mark of distinction. It reflects TrollCo's concern to offer quality engineered products at competitive prices and it has a strong bearing on the documents they have use and generate.

2.2 Empirical Approach

Generally, TrollCo's engineers were happy to volunteer stories, scenarios and information about how things are carried out. However, they would not formally allocate time to interviews or questionnaires. Hence, the data gathering has been to date relatively 'informal'. We have relied on pen and paper based observations, examination of physical & computer based documents, supplemented by informal and ad-hoc interviews. Iterative discussions with TrollCo's engineers have taken place concerning the example documents supplied and the resulting models generated.
The documentation profiling worked 'outwards' from an individual engineer's desk and computer to the documents held by their workgroup and organisation. Information was captured about documents on their local hard disk; the content and structure of their bookmarks and email; and the files they maintain and have access to on shared networked drives. Piles, files (and cabinets) from their desk area were also 'captured.' At the group and organisation level, records were made of shared filing cabinets and cupboards, and all the files available on the network drive, as well as how the movement of file around the organisation.

2.3 TrollCo Have

Across the two divisions, our analysis to date shows over 250 different distinguishable document types amongst the thousands of documents held by TrollCo. These types range from expected documents, such as design specifications and parts catalogues, to TrollCo specific documents and obscure tomes on welding procedures. The ISO 9000 standard (BS:EN:ISO:9000 2000) lists six forms of document type: Manuals, Plans, Specifications, Guidelines, Procedures, and Records. Instantiations of these can be found throughout TrollCo, but their documents reflect a variety of concerns and have different manifestations and life spans. They cannot be easily wedged into the ISO classification. The multifaceted nature of TrollCo's documents inspired the work on document profiling, which aims to describe and profile the richness of engineering documents.

2.4 TrollCo Use and Generate

TrollCo uses and generates a large number of routine documents. A number of them are generic to both the Engineering Services and Product Divisions, but here we focus on the documents within the Product division. Table 1 illustrates the key documents used and generated in the product division in relation to a number of phases of activity. Following the distinction between routine and exception tasks in other work study methods (e.g. Malone et al . 2003, Wild et al . 2004) we make a distinction between routine and exception documents. Routine documents are those that are central to documenting an order fulfilment. As they are generated and used, they are placed in a Job Folder,

which lists essential information on the cover (i.e. job number(s), customer name, outline of product). In contrast, exception documents represent deviations from the desired path from order to payment, and are generated and stored after inspection by the Quality Manager. Table 1 illustrates both routine and exception documents, and was developed in collaboration with TrollCo engineers.

Table 1. TrollCo's Product Division Documents (Using and Generating)

PRODUCT DEMONSTRATION / ORDER /	BUILD	TEST / ASSESS QUALITY	DELIVERY	FINANCE	SERVICE / MAINTENANCE
Brochure Demonstration-request Draft Order Draft Quote Final Quote Final Order Order-acknowledgement	Contract Review Production programme Product stocking sheet Planning sheet Call off sheet Welding build sheet Sub assembly build sheet Time & Temp Requirements Electrical options	Final inspection check Certificate of conformity	Advice Note Maps	Invoice	Routine Service Customer Feedback form Parts order form
Exceptions / Options					
Credit checks	Internal reject note, External reject note, Supplier Quality Approval Record, Corrective action request form and Vendor assessment form			2nd Invoice Legal proceedings	Breakdown Checklist Call out Service

The engineers at TrollCo consider their document usage to be somewhat 'chaotic,' and we stress that this is their view, as to us the documents generally have the required information, with straightforward layouts and meanings. Rather the document 'chaos' appears to stem from: 1) ambiguity in orders; 2) needing to deal with multiple instances of orders; and 3) the variety inherent in the product line and customer needs.

An important part of the process is making sure an order is fully specified. At TrollCo, this is a mild source of tension between personnel in marketing and those in product development and manufacture. When an order comes in it is often 'weakly' specified or unstable. The order can refer to past orders without a corresponding job number; and/or is missing specification of key components; or be liable to change. Despite generic features in their products that could be assembled prior to an order being finalised the quality procedures prevent the start of manufacture until all the information is fully specified. With tight delivery deadlines this can lead to pressure on TrollCo, they are deemed to fail if a product is late, but if a customer produces a weak specification they cannot go ahead with manufacture. Some attempts at support have been attempted, but much of the process of creating a complete specification for a product order comes from regular but ad hoc meetings between production and marketing and resulting questions being made of the customer. Within these meetings, documents are compared; annotations made and needed information is specified; this is then used to ask customers specific questions. In these situations, faxes or emails are passed between TrollCo and the customer and these artefacts often show the layers of questions and responses.

2.5 Other Findings

2.5.1 An Unused Catalogue Taxonomy

One file cupboard examined contained a series of suspension files, some containing catalogues. Each suspension file was marked with a main category and subordinate category. The main categories

were: Bearings; Electrical & EMI shielding; Fasteners; General, Hydraulics; Metals; Plastic; Processes and Seal / Packing. The sub-categories varied in number from 2 through to 7 elements. For example, bearings catalogues were subdivided into Locknuts, circlips, nuts, bolts, plastic, angular contact, ball & roller, Ballscrew & linear roller, Needle, Plummer blocks brg units, Self Lube, Transfer Tables / Slides ways.

This catalogue taxonomy was locally developed, reflecting materials used in the past and still in use today. However, whilst examining and recording the contents of this cupboard it was apparent that it was 'neglected.' Contemporary storage for catalogues comprises the two recommended catalogues held in a publicly accessible place; those hidden away in drawers; and those stored in other cupboards.

The full time engineer (and therefore part time librarian) in charge of catalogues noted that the demise of the official catalogue taxonomy was due to a number of factors: time, location, and supplier management strategy. Catalogue use, generally during design, was undertaken in three different offices across the two divisions. Logging and storing new catalogues was difficult because engineers were prone to wondering off with new or interesting catalogues. This was compounded by the engineer/librarian spending long periods away from his desk building and testing equipment. Catalogue proliferation was due to engineers trying to reduce the cost-base for a product by shopping around. This did however create a tension with the desire for fewer suppliers with longer-term relationships. Adjacent to the 'official' catalogue cupboard was another cupboard with containing around 50 catalogues – in some cases dating back 10 years – and other design and reference documents. Reasons for the retention of catalogues include: 1) a lack of consistent product documentation; and 2) the 'hybrid' nature of the product's manufacture leads to the need to retain information sources on a 'what if' basis. Products are a combination of custom-made parts and off the shelf stock.

2.5.2 Paper verses Electronic Documents and Files

TrollCo engineers make frequent use of search engines to look for products and suppliers. Despite the multitude of suppliers and customers, there is minimal use of bookmarks, and the file structure in email clients is the default in and out boxes. There is minimal correspondence between the organisational structures of bookmarks, email and personal or shared files (c.f. Boardman and Sasse 2004).

The overall organisation of electronic files is noticeably different from those in paper form. Naming and hierarchy conventions in files are variable and inconsistent between electronic and paper manifestations.

As an example, for one product, PRODUCTNAME1, online files are stored in a top level directory named H:\PRODUCTNAME1 BIBLE 10.9.01\. In contrast most of the design files relating to PRODUCTNAME2 are stored as H:\ENGINEER NAME \C.A.D.\PRODUCTNAME2\. Other electronic files, such as manuals and user guides relating to both PRODUCTNAME2 and PRODUCTNAME2 are scattered across the network drive and various engineers' hard disks.

In contrast the paper-based catalogue and specification archive details holds A4 ring binder files for PRODUCTNAME1 and PRODUCTNAME2. These physical files are more consistently named and located than the electronic versions. They are also more complete in their coverage, covering aspects of the design and use of the products.

As we have examined documents, we are struck by the paucity of binding and container mechanisms in computer environments. Currently expressing which files belong together is difficult compared to paper-based environments. If two or more documents happen to share a name, they can be listed together. However, 'native' support for files that logically or semantically belong together can only be effectively grouped by a subfolder, leading to a proliferation of directories. A typical file system allows default sorting of files by Name, Size, Type, and Date, whilst windows based systems, have a number of other file listing attributes they are rarely used. In contrast, there is a variety of methods for grouping two or more physical documents together such as stapling, folding, piling, paper clipping, and binding. In turn, physical grouping mechanisms can be applied recursively to a set of documents. For example, a TrollCo design specification folder examined had a number of labelled subsections. In each of these subsections, documents were folded together whilst also being stapled together,

indicating groupings and sub-groupings of documents. Ordering of documents in computer based file systems is limited, even numbered documents will only order correctly if the label is numerical and numbers below ten include a zero (i.e. 01, 02 vs. 1, 10, 11). Some physical bindings are no doubt accidental, reflecting what was to hand at the time. So folding in the absence of a stapler may be as meaningful as a fully stapled group of documents. However, repeated patterns of stapling, folding, as well as permanent and temporary binding, can be seen throughout TrollCo's paper based documents. These in general have a semantic value that could be exploited in the design of file and document systems.

Containers in paper documents are also richer and can be more easily annotated than computer files (e.g. folders, files, cabinets, and shelves). TrollCo's Job Folders are annotated with essential information on the cover such as job number(s), customer name, and an outline of product ordered. The closest vehicles for such document groupings are email attachments and tailored web pages. These provide an element of context and possibly a meaningful order to the documents. Such 'contextual' grouping mechanisms in combination with enhanced binding mechanisms should provide a more powerful way of grouping related documents both for requirements tracing in design work or workflow monitoring in 'paper' work (see also Bondarenko and Janssen 2005).

3. Describing and Profiling Documents with Facets

3.1 Motivation

The work reported in this section has two motivations. As we noted in section two TrollCo has more than 250 'types' of documents, with many varieties of instantiation. Hence, the first motivation is to outline how we 'simply' describe the richness and variety of engineering documents that we have examined at TrollCo. The second motivation is to be able profile an organisation's documents. What we have in mind is being able to profile the documents that a person, group, or organisation has. Being able to profile each organisation will be useful in helping us to provide meaningful feedback to participants. For example, we would expect differences between 'pure' design and 'pure' manufacturing organisations, whereas an organisation such as TrollCo has a profile that reflects both design and manufacturing organisations.

At the heart of the first part of documentation profiling is a set of facets for describing documents. There is often a concern to express classification as being cleanly top-down or bottom-up process. The development of this work has been middle out. As our engagement with TrollCo's documents has evolved, facets have been moved, scrapped refined and as new work has come to our attention additional facets have been added. This moves away from the approach to facetted classification that Ranganathan suggests, which is rationalistic, non-empirical, and bound to the context of libraries. But as Hjørland (2005, p.144) notes Ranganathan's "is a position that does not consider the empirical basis of systems very much." In contrast modern empirical enquiry combines rational or theoretical elements with data derived from the world (Robinson 1999). Overall, our concern has been to reflect both the nature of the documents we find and theoretical aspects of relevance. Table 2 lists our facets, those italicised in table two, are explored in more detail in section 3.2.

Table 2. Overview of the Facets for Profiling Engineering Documents

GROUPING	FACETS
Context	Source, *Product Phase, Functional Concern*, Quality Activity
Manifestation	Document Status, Distribution Status, *Manifestation,* Manifestation Mechanism, *Grouping Status (Physical & Electronic),* Class-Instance Template Status, Annotation, *Document User Interface*
Type	Purpose, ISO 9000 Type, Document Type

3.2 Elaboration of Some of the Facets

3.2.1 Document Purpose

The document purpose facet aims to represent the overall purpose(s) of the document. Purpose is concerned with the representation of communicate reasons behind actions and artefacts such as documents. The notion of a speech act is a theoretical position developed by Austin (1962) and Searle (1969) which is concerned with the communicative purposes in linguistic acts. As such it is an account of language concerned with pragmatics rather than syntactic or semantic analysis (c.f. Winograd 1987). It has been used in organisational and design contexts by Winograd (1987) and Yoshioka et al (2001). Winograd's Coordinator system (1987) imported its terminology from Searle (1969), so for example we have: *Assertives* which commit a speaker to some things being the case -- to the truth of the expressed proposition, and *Directives*, attempt to get the hearer to do something. The Coordinator system provided facilities for generating, transmitting, storing retrieving, and displaying messages that indicated their 'Speech Act.' Messages could be marked with their communicative intent. In practice, we have found Winograd's terminology difficult to apply. So for micro-level documents purposes we have adopted the purposes used by Yoshioka et al. (2001) namely, *Inform, Request, Express, Decide, Propose, Respond, Record,* and *Other*. In addition, we have four macro-level document purpose facets, *Learning, Transactional, Routine,* and *Exception*.

3.2.2 Product Phase and Functional Concern

This facet concerns the product phase that 'uses' a document. We have adopted and adapted BS 7000 (BSI:7000 2000, p. 17) which lists *Concept, Feasibility, Design, Implementation, Manufacturing*, and *Termination*, as design phases. In addition and in response to several standard TrollCo forms and processes a *Maintenance* phase has been added. From the study at TrollCo, we have observed that engineers use and generate financial documents, and that documents reflect and/or are used by several functional units within an organisation. For example, assembly instructions are both a quality document and a manufacturing document; costings have both engineering implications and financial impacts. The MIT process-modelling handbook (Malone et al . 2003), serves as a repository of knowledge about organisations and provides case examples expressed in a common format and framework. The following areas of functional concern are listed in the Process Handbook: Develop Vision and Strategy; Design and Develop Products and Services; Market and Sell Products and Services; Deliver Products and Services; Manage Customer Service; Develop and Manage Human Capital; Manage Information Technology and Knowledge; Manage Financial Resources; Acquire Construct and Manage Property; Manage Environmental Health and Safety; Manage External Relationships; and Manage Improvement and Change. They 'abstract' across the naming idiosyncrasies of organisation's different functional divisions, and by representing them as non-discrete facets, we can a) account for documents that are embedded in multiple functional divisions, and b) profile differences in document types between organisations.

3.2.3 Manifestations and Groupings

Here we concern ourselves with facets for *Manifestation, Grouping Status,* and *Document User Interface*. The *Manifestation* of documents depends on a variety of factors including the tools that the documents are created and viewed in, and the attitudes and culture of the host organisation. One of our concerns is whether a document is manifested *solely* physically or electronically, or if not, whether a document predominantly manifests itself physically or electronically, with occasional use of other manifestations. At TrollCo, purchase orders and order acknowledgements are predominantly paper-based, but are sometimes sent as email attachments or faxes. In contrast, most design specifications and drawings are electronically created and used, with paper being used for archiving purposes in design manuals and job folders. Following on from our observations in our case study (see section 2) grouping status concerns, the physical or electronic mechanism used to group related documents together. Unsurprisingly there are more options for paper than for electronic grouping manifestations.

3.2.4 Document User Interface

The notion of a Document User Interface views some documents as being a user interface, for gathering information in a structure format. So a form is a user interface for generating a paper based record, a checklist an interface for recording things that have to be done.

3.2.5 An Example Profile: Purchase Order Document Class

Our concern is to illustrate briefly the profiling method. Clearly, with over 250 document types and thousands of documents space precludes a full profile. What we present here is an attempt to illustrate the profile for one class of TrollCo document. We choose Purchase Order, because it is a class of document that TrollCo both receives and generates. Therefore, there is a rich variety of instantiations to consider. Whilst not a classical engineering document it is used within both of TrollCo's engineering divisions and frequently co-occurs with other documents such as design specifications.

Table 3. Sample Document Profile for the Document Class Purchase Order

FACET	RESPONSE	FACET	RESPONSE
Manifestation		**Functional Concern**	
Manifestation	Physical & Electronic	Distribution	No
Electronic Mechanism	Word Processor	Develop Vision & Strategy	No
Physical Mechanism	Fax, Printer	Design & Develop Products & Services	No
Grouping	Grouped	Market & Sell Products & Services	Yes
Physical Grouping Mechanism	Job Folder	Deliver Products & Services	Yes
Electronic Grouping Mechanism	Rare, attached to email	Manage Customer Service	Yes
Annotation	Yes, notes	Develop & Manage Human Capital	No
Paper-User Interface	Form	Manage Information Technology & Knowledge	No
Template Status	Known -Electronic	Manage Environmental Health & Safety	No
Class Or Instance	Class	Manage External Relationships	No
Purpose		Manage Improvement & Change	No
Request	Yes	Manage Financial Resources	No
Express	No	Acquire Construct & Manage Property	No
Decide	No	**Type**	
Respond	No	ISO Type	Record
Record	Yes	Document Type	Document Class
Inform	No	Administrative Documents	Preliminary contract
Other	N/A	Descriptions: Main Descriptions	N/A
Transactional	Yes	Description: Appendices	N/A
Learning	No	Development Plans	N/A
Routine	Yes	Utilisation Documents	N/A
Exception	Sometimes	Quality Control Documents	N/A
		BS Design Phase	Manufacturing

Having shown how we can describe and profile engineering documentation with a rich set if facets, we move onto to show how we can deepen our analysis of documents by situating documents in work practices.

4. Situating Documents in Work Practices

The activity being undertaken with documents is essential to understanding why they exist and how they are used. As seen in section 2, a number of factors affect the manifestation and use of documents. The tools available to create documents have a bearing on what documents are created and how they are passed around and between organisations. At a higher level the culture of an organisation also affects why certain documents exist in the first place. At TrollCo, the adoption and use of the BS/ISO 9000 standard has considerable influence on the range of documents they have, use, and generate.

Table 4. Situating Documents in Work Practices

	MODELLING ISSUES & ELEMENTS	HAVE, USE, GENERATE	TROLLCO EXAMPLES
CULTURE	Influences, overlap, Standards and policy, power, breakdowns, values, identity, emotions, style, preferences	How the culture influences which processes and documents are undertaken	The influence of ISO type documents, and the overall concern with maintaining BSI. Pride in the quality of the product. Fiercely competitive and litigious competitor. Work culture, staff culture. Culture of purchasers, (size, government, industrial). Informality and hands on nature of the design culture. Staff and recruitment issues.
FLOW	Roles, Agents, Goals, collaboration structures. Central and representative roles	Which roles and agents own and archive documents Which are the key documents? Which people are documents passed onto?	For general flow see cells in table 1. To-from customer. Flow between staff in: engineering; marketing; finance; production; and quality managers. To-from suppliers. To-from other bodies (tax, quality and financial auditors
SEQUENCE	Task and Sequence models	What is the sequence of document use? How are the documents are generated? ISO processes and documents	See individual cells in table 1 for order
ARTEFACT	Artefact models, document types and manifestations, document creation and exchange tools. Document proxies, central and representative artefacts.	Manifestations, (e.g. email, fax, letter, paper, electronic) Bindings Containers	Templates, printers (individual and shared), fax machines (in various locations) photocopier, software artefacts (CAD, word processors, email, web browsers, PDF related tools). Manual tools, staplers, pens, pencils, cabinets, cupboards, files, archives, shelves, desks, paper pads.
PHYSICAL	Location of artefacts, office layouts	Movement of documents and related artefacts around the site	Physical location of documents, archives (multiple), location of tools and artefacts, physical distance between staff in marketing, finance, engineering, and production. Physical location of staff and offices, suppliers (UK, and Europe) and customers (UK, Europe, USA, and Australia).

The following conceptual framework is used as part of the representation of our understanding of documents as we undertake documentation profiling. Table 2 illustrates the framework. The left hand column illustrates a number of issues that have their roots in literature on the modelling of work (e.g. Beyer and Holtzblatt 1999, Trætteberg 1999, Wild et al. 2004). The second column lists typical

questions we ask when considering what documents are held, used, and generated. The third column gives examples of issues from the case study reported in section two. Five different levels have been influential in framing our understanding of documents and each row represents the context of documents at levels concerning Culture, Flow, Sequence, Artefact, and Physical (c.f. Beyer and Holtzblatt 1999). Without consideration of physical layout and cultural issues, understanding why certain documents exist and are used in certain ways is hard to ascertain. The failure of the catalogue taxonomy discussed in section two draws on physical and cultural aspects at TrollCo.

Of the five layers, we view Culture and Artefact as most interesting and unexplored. There is a body of work on the modelling of processes / tasks / workflows (e.g. Johnson et al . 2000, Trætteberg 1999, Wild et al . 2004), and location is generally tangible and uncontroversial. However, the culture of an organisation or group of engineers has significance to the forms of written expression they use and the manifestations that they generate (c.f. Hall 1966, Heaton 2002).

In turn detailed analysis of the artefacts can suggest new designs for individual document formats as well as document grouping and filing mechanisms (c.f. Beyer and Holtzblatt 1999). In the context of this paper, many of the issues we raised in this paper in section 2.4 are relevant for the consideration of artefacts. Examination of artefact issues generates requirements for electronic documentation. Paper and related filing technologies has many important affordances (c.f. Sellen and Harper 2002), which should be in some ways replicated in modern computer systems. This should not however be interpreted as a ludditte call for a return to physical paper. Rather in moving forwards with electronic files and documents, we should retain the strengths and affordances of the physical paper (e.g. stapling, folding, annotating, flipping for browsing) and moves forwards with features such as: auto summarisation, richer and faster search mechanisms, mark-up, searching of meta-data, and document decomposition (c.f. Liu et al. 2006). Intermediate solutions can be envisaged using current technologies such as vanilla web pages, Wikis, and social browsing mechanisms. A Wiki could be set and grouping mechanisms such as staples can be simulated through placement of documents together within a page. However, mechanisms that go beyond methods that are native to standard operating systems do have usability and training implications.

5. Conclusions and Future Work

This paper has outlined work towards an engineering documentation profiling method, focussing on what documents users have, use, and generate. What documents an engineer or engineering organization have, use, or generate leads us to consider why documents exist, what their strengths and weaknesses are, and how they support engineering and manufacturing processes. We discussed interim findings from our first case study concerning the types of documents that one organisation TrollCo, have, use, and generate; as well as the differences between paper and electronic documents and files. We have also outlined two modelling approaches that reflect our concern with situating documents in context and work practices, and describing / profiling document collections.

Future work pertains to: 1) applying the documentation profiling method in other engineering organisations; 2) increasing the methodological rigour in data gathering; and 3) developing the approach into a tutorial format to remove craft skill issues in its application by the research team.

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