WOMEN'S ROLES IN OPERATIONS: AN EXAMINATION OF PHOTOGRAPHS DEPICTING WOMEN AT WORK FROM 1870 TO POST-2000

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Abstract

The research used content analysis of images from four periods and photo libraries to show how women working in manufacturing operations have been depicted in photographs. The research suggests that photographs taken during World War 1 show women working in a wider variety of different operations – from toy manufacturing to shipbuilding – than was the case for images from World War 2 and from a modern photo library. The work also suggests that earlier images show operations as more sociable, with more evidence of interaction between workers. There is evidence that the way in which women

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Introduction

The literature on women in operations is sparse. Growing research on behavioural operations acknowledges that people, with all their many differences, determine much of what happens in operations. Yet most operations management literature continues to assume that operations problems, and their proposed solutions, are gender neutral, and that the sex of workers in operations is not relevant to any analysis. There is also a widely recognised under-representation of women in some areas of operations, notably in parts of manufacturing operations, and in the management of operations. In a society in which people have access to photographs, and more and more photographs are being taken and shared, the impact of visual messages on people's expectations of operations becomes increasingly of interest. This paper examines how women are depicted in photographs that show manufacturing operations, and addresses two research questions:

RQ1: *How are women depicted in photographs of manufacturing operations?*

RQ2: *How have the ways in which women are represented in images of manufacturing operations changed over time?*.

The work contributes to the broader debate on behavioural operations and uses a methodology that is novel to the field to show how the depiction of women in operations has changed or remains unchanged. At a time when discussions of pay and equality at work are coming to the fore it contributes to the broader discussion of women at work in an operations context.

The paper starts with a brief literature review and description of the motivation for the research. The methodology for selecting images and examining them using content analysis is then described. The outcome of that analysis is described in the Results and Discussion section. The paper concludes with a summary of the main points, acknowledgement of the limitations of the research and some suggestions for further work.

Literature review on women in operations

The emergence of the field of behavioural operations acknowledges that people play an important role in ensuring that operations work, and that we cannot always assume that those involved in delivering operations are neutral in their actions or their stance (Bendoly et al. 2006). Yet operations management researchers have largely neglected the role played by gender in operations, aside from recognising that some areas of operations tend to employ more women, at least in the lower paid jobs, and others are male dominated. An examination of the portrayal of professional and managerial women in North American films noted that "social attitudes, values and belief systems are in large part shaped, perpetuated, and reinforced through projected images of professional women in the media" (Ezzedeen, 2013) and found that the depictions of women often painted a negative picture of their work and emotional lives. The depiction of operations could thus shape society's response to different roles and expectations of women in operations.

Recently published statistics suggest that women are, for example, under-represented in supply chain management roles in the UK (Fourtané, 2016), and a survey of US Fortune 500 companies by SCM World found only 22 women in top supply chain executive roles in 320 companies (SCM World survey, cited on eSourcing Forum, 2015). The UK has recently required organizations with more than 250 employees to report figures comparing the average pay for men and for women in the organization. staff to report their gender pay gap (UK Government, 2018). The reported results show that in most organizations the average pay of women was lower than that of men, and at the extreme the pay gap in some organizations was as high as 70%. One reason given by many organizations is the imbalance in genders at different levels in the organization, with men mostly occupying the higher paid executive roles and women disproportionately represented in the lower paid roles.

Among the reasons identified by Oakley (2000) for the low proportion of female CEOs is the fact that women are often not offered the opportunity to work in the areas that are traditionally expected for advancement to the most senior positions in organizations: while men gain experience in marketing and to an even greater extent manufacturing and operations, women tend to be offered roles in supporting functions such as human resources and public relations. Later in their careers women are deemed not to have the experience traditionally required of those being considered for CEO positions. Even where women are present in operations – usually in the lower and less well-paid jobs – they are often present in roles that are traditionally "women's work", and women in these roles are often managed by men (Metters, 2016).

The dearth of women in senior positions in companies, and in particular in the mainstream roles, has long been described as the glass ceiling. While initiatives have been undertaken to try to remove this ceiling, it has remained largely intractable. The absence of women from traditionally male operational roles has implications for organizations and broader society. One reason – of many - suggested for the absence of women in operations roles is a lack of awareness of the types of roles available (Fourtané, 2016). In a world where photographs are becoming more and more plentiful,

images that show women working in operations management roles can help to raise awareness of the variety of available operations jobs, and of the working conditions of those jobs.

Methodology

The research used content analysis to examine photographs of women involved in materials processing operations in four different periods. Content analysis is a methodologically explicit approach to analysing images (Rose, 2016) that follows a well-established set of steps: (i) identifying and selecting images; (ii) developing coding categories; (iii) coding images; and (iv) analysing results.

Koboyashi et al. (2008) describe four types of photo analysis that involve the researcher in either taking or commissioning the photographs involved in the study. A fifth option is to look at photographs that have been taken by others; this approach enables longitudinal studies beyond the lifetime of a single photographer. This last was the approach used in this research, enabling the examination of photographs covering more than a century. All photographs used in the research were created in the UK (or were attributed in key-words to the UK), and were assumed to be substantially unmodified (no significant elements were added or subtracted), either in the darkroom or through the use of image processing software such as Photoshop. Because of the large number of images available depicting women at work, the sample was not exhaustive. Nor, given the range of possible images, was it necessarily representative of all images of women's occupations. To make the analysis manageable in the time available, the sample was limited to materials processing operations (no pure services were included).

Sample selection

The research examined photographs of women engaged in operations from different periods. The selection of the four representative periods for images was pragmatic – they represent different points in history for which we can readily identify image sources, and for which it is known that women were involved in manufacturing operations. These periods were selected because (i) there are photographs publicly available, either in archives or photo-libraries; (ii) they represent different times in history; and (iii) in two of the four cases, they represent times when women were engaged in the two World Wars in what was traditionally regarded as "men's work". The research used: (i) the work of Frank Meadow Sutcliffe (FMS), whose photographs between 1870 and 1910 depict workers from in and around Whitby, particularly those in the fishing industry; (ii) photographs of factory workers during World War 1 from the Imperial War Museum's collections (WW1); (iii) women photographed during World War 2 from the same collection (WW2); (iv) images of women working in operations management in the 21st century seen online from the Alamy stock photography agency (Alamy).

Table 1 summarises the sources of images and the number of images examined from each picture library. The abbreviations in the final column are those used in the subsequent discussions. In total, 172 images were coded. Some libraries contained multiple images taken in the same work settings. Where images were very similar only one was examined, but this involved some judgment and also remembering earlier photographs.

The analysis concentrated on Sutcliffe's 103 images of fisher people as likely to portray people in operations. Twelve images were studio portraits and were therefore discounted. Another thirty-nine images include only men (children have not been

included as gender is not always clear). Twenty-eight images include both men and women and twenty-four images show only women, meaning that 52 images depicted women. Of these fifty-two images, nineteen were identified as clearly showing women at work, processing or selling fish or shellfish, collecting shellfish, or mending nets (in some images it was unclear whether the work being carried out was domestic work or not: these were excluded from the analysis).

Table 1. Summary of sources of images and search terms used

Collection	Location	Search term	Number of images	Abbreviation
Frank Meadow Sutcliffe	http://www.sutcliffe-gallery.co.uk/_photo_3182297.html#photos_id=3197572 Fisher people collection	Not applicable	19	FMS
Imperial War Museum	FirstWorld War Women's War Work Collection https://www.iwm.org.uk/collections/photographs	Not applicable	78	WW1
Imperial War Museum	https://www.iwm.org.uk/collections/photographs	World War Two Women Factory	27	WW2
Alamy	www.alamy.com	women working UK manufacturing	48	Alamy

The second set of images was taken from the collection in the UK Imperial War Museum, and examined photographs in the First World War Women's War Work Collection, limiting the images to those key-worded "manufacturing". Using this filter produced 86 images. Of these, it was not possible to determine what was happening in eight images, leaving 78 images to be analysed.

It was more difficult to identify women at work images in the UK Imperial War Museum collections for the Second World War. Images were identified in the Ministry of Information Second World War Press Agency Print Collection by adding the filter "women" to give 32 images. Of these images, two directly showed women working in factories. A further searching with the term "World War Two Women Factory" resulted in ninety-five items. Of these, some were images from World War One and were eliminated as showing the wrong time period. Others showed women in domestic settings or situations that, while work-related (for example, eating in a workers canteen), did not involve the women performing work. Several items were albums that could not be accessed on line. This resulted in 24 images for examination.

The final set of images was from the Alamy picture library. A search using the terms "women working UK manufacturing" returned 86 images, though several of these were plainly not manufacturing or not in the UK. In addition, 7 images were omitted as not fitting in the period of interest (post-2000), and some were close duplicates and not included in the analysis. In total, 48 images were examined.

Where they were provided, captions were used to help determine the context for the image and to help to identify the sector. Each image was assigned an identifier based on that attached to the image on the relevant website. The results from all the analyses were stored in an Excel Workbook, with each set of images given its own spreadsheet. Where codes could not be assigned unambiguously, a question mark was used to denote doubt. Images with a question mark in any of the columns were revisited, but it was not possible to resolve all ambiguities.

Coding

A search of the literature did not find any coding of images of operations management. Consequently, ideas for codes were sought in the broader literature on images and operations management. Two codes emerged from Metter's (2013) work, those for "context" (based on his discussion of perceived areas of "women's work", and evidence of interaction between workers, following his discussion of mass psychogenic illness, and a perception that women look positively on a sense of community in the workplace. A further code to look at the nature of work (light manual, heavily manual, machine minding) proved problematic, as it was difficult to interpret in many contexts exactly which part of the process women were involved in. The code identifying whether a photograph was candid or posed was prompted by Kellaway's (2016) article on the depiction of women in corporate brochures. Another code accounted for the gender of those in the photograph, and where possible a count of both genders was made, though this revealed little in the analysis, but was useful in determining explaining the absence of interaction when only one worker was present.

Results and discussion

Table 2 shows the different contexts of the images. Unsurprisingly, given Meadow Sutcliffe's location in the harbour town of Whitby and his interest in the fishing community, fishing, and to a lesser extent retail, are the subjects covered by his images. The images from the First World War Women at Work collection are more diverse in their contexts than those from the Second World War, with more sectors (for example toys and linoleum) not directly associated with war represented in the images. Perhaps surprisingly, the range of sectors identified with women and manufacturing in the Alamy collection is narrower than for either war period. Many of the photographs depict what might traditionally be seen as "women's work" such as food preparation, or electronics assembly where dexterity "nimble fingers", often associated with women, are seen as an asset (Metters, 2017). Similarly, photographs of the collecting and processing of shellfish at the time of Sutcliffe often show it to be the task of women. In contrast, depictions of women in wartime show many involved in engineering tasks, including "heavy" engineering settings such as shipyards and moving around heavy items such as full sandbags.

Table 2. The contexts of images in each image collection

Collection	Contexts (sector)
FMS	Fishing, retail
WW1	Shipbuilding, engineering, glass making, hut building, toys, aircraft, ironwork, linoleum, woodwork, net, bathroom ware, boots, fused silica products, textiles, clothing, sandbags
WW2	Shipbuilding, barrage balloons, munitions, pumps, tanks, aircraft, chemical, uniforms
Alamy	Engineering, electronics, food, first aid boxes cigarette, lighters, roof tiles

As well as looking at the sectors in which women were employed, the presence and absence of men in the images was also considered. The aim was to try to understand the extent to which women and men are seen in working alongside one another. The results from this analysis are shown in Table 3.

Table 3. Number and proportion of images with just women or with both men and women present

Collection	Women only	Men and women	Women only %
FMS	11	8	58
WW1	63	15	81
WW2	19	8	70
Alamy	41	7	85

In all collections, the majority of images show women only, with the proportion being particularly high for WW1 and for the picture library images (Alamy) showing modern women in manufacturing settings. Whereas the absence of men from the workplace in times of war is not difficult to explain, particularly given that it was their absence that meant many women were working in manufacturing operations, the depiction of modern manufacturing operations as women only workplaces is more surprising. The results may arise because many of the Alamy images depict women in settings that are traditionally perceived as "women's work", such as food production and electronics assembly. Where men may be present, they are often distant figures in the background and not identifiably part of the message or narrative of the image. One notable exception was an image of an electronics assembly line where a narrow depth of field showed a man was sharply in focus while the women surrounding him were blurred. The FMS photographs are notable in showing women and women, and men and women, interacting in a higher proportion of the images. This may result from the more casual settings for these photographs, with the images often taken outdoors, on quaysides or outside houses as opposed to the more formal workplaces of later images

In examining the images it was clear that, while some images were carefully posed others seemed to be more spontaneous, showing people working either unaware of the camera or not obviously reacting to its presence. In determining whether an image was posed or candid several factors were considered, notably whether those being photographed continued to work or stood looking at the camera. It was assumed that where subjects were engaged in work – often seeming totally absorbed in the task – and not looking at the camera that the shot was candid, while recognising that workers may have been instructed to behave in a particular way for the photographer. Where there was a lot of ambiguity, the photographs were assigned to a third category of "unclear".

Table 4. Number and proportion of images that were posed vs. candid

Collection	Posed	Candid	Unclear	Posed %	Candid %
FMS	3	12	4	16	63
WW1	24	34	20	31	44
WW2	2	23	2	7	85
Alamy	10	28	10	21	58

Only the WW1 images seemed to lack a majority of candid photographs. In part, this may have been a consequence of the technology available to photographers at the time and the fact that many photographs were shot inside factories where light levels were low. In contrast, all of the images from FMS were taken outdoors, making candid photography much more straightforward. In the posed photographs there were two particularly distinctive types. In the WW1 sample the majority of posed images showed

workers – often several of them – staring solemnly at the camera while still at their normal work stations. The images suggest that work is a serious business and needs to be viewed as such. In contrast, several photographs in the Alamy collection depicted good looking women in smart business suits posing in pristinely clean engineering factories, while holding clipboards or electronic tablets, or wearing gleaming white lab coats. In some images the women were alone and in others they were shown with similarly smartly dressed men. No equivalent images were present in the other image collections. This genre of photography has been criticised for prioritising the looks of women over the actuality of them working (Kellaway, 2016).

Another analysis examined whether there was evidence of interaction between workers (see Table 5). Interaction was selected as a variable because of the perception that women may value community in the workplace. In this case, "yes" means that there was evidence of interaction, and no meant that there was no evidence of interaction. This is not the same as saying that there was no interaction, but simply that there was no evidence of interaction. Evidence of interaction includes people apparently talking or laughing together, or working together in a way that meant that communication was essential (for example, two women operating a large press). The "not applicable" identifier was used where there was only one person present in the image. The proportion of images suggesting worker interaction has fallen with time, at least in part because of an increase in the number of photographs depicting just one person; this is particularly noticeable in the Alamy set, where nearly 50% of the images contain just one person. In some of these later images only a small part of the person is shown (usually the hands) and the fact that it is a woman in the image has to be inferred.

Attempts to analyse the exact nature of work being undertaken were problematic. There is no doubt that, particularly in the images taken during the war years, much of the work was in difficult working conditions, in places like shipyards and chemical works and involved heavy lifting and handling of nasty substances. However, the categorisation of the precise nature of the work was often difficult, particularly where women were seen assisting men or where women were posed besides equipment and not obviously interacting with it. In contrast, the recent Alamy photographs depict clean working environments (even in pharmaceutical production the equipment is gleaming and though the women are shown in boiler suits, they are pristine. It would have been interesting to look at images of women in roles in heavy chemicals or dyestuffs, where cleanliness is less important, but there were no images present in the collection) and light work.

Table 5. Evidence of interaction between workers

Collection	Yes	No	Not applicable	Yes %	No %
FMS	13	3	3	68	16
WW1	40	8	30	51	10
WW2	10	15	2	37	56
Alamy	6	16	26	13	33

Conclusions and limitations

The use of images in operations management research has, to date, been limited. Likewise the issue of gender in operations management research has been largely overlooked. This research has used images and visual analysis to investigate how

women working in operations management have been represented at four different time periods.

The images sampled show women undertaking a wide range of different work in different settings. In earlier images they are depicted in their normal working clothes, often interacting with one another (FMS) or with the work environments. In the periods of war, women in the UK are shown as having moved out of more traditional "women's work" and into engineering and heavy production roles. Women are sometimes shown working alongside men, particularly in earlier images. The post-2000 images, in contrast, tend to concentrate on women on their own or in all-female settings. In contrast, modern images of women tend to show them in clean environments, often without men present (more so than earlier images) and there are images of beautiful women in business dress standing in pristine manufacturing environments that are noticeably absent in the earlier collections.

The research has several limitations. First, the selection of sources of was opportunistic and based on knowledge of image collections available on the web, rather than on a systematic search. This was a pragmatic solution to the very large number of photographs available for analysis and for the need for ready access to images to test the methodology. While the opportunistic approach was viewed as acceptable for this study, a more extensive search for a wider range of representative images will make the work more comprehensive. Second, only one person analysed the photographs: it is possible that some categorisations might have been viewed differently by a second person. Third, the initial codes chosen would benefit from further refinement, in particular to try and create a distinction in the types of work being undertaken. Further work is now needed to refine these codes and to identify other potential codes and image sources that would provide further insight into the depiction of women in operations. Fourth, the work has looked so far only at the representation of women. It would be interesting to compare the results of this study with one that examined the depiction of men in operations management. This can readily be done for the FMS and Alamy collections, but is more problematic for the two wartime era periods when the presence of women in the workforce is at least in part a consequence of men being called up by the military. A deeper investigation of more recent images is also required – the current work was undertaken using only one picture library. Further work will look at other stock picture libraries to address this limitation. Finally, this work largely involved counting, without paying close attention to the relationships within the images. Further work could usefully examine factors such as evidence of power relationships, which were beyond the scope of this work.

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