CIFE CENTER FOR INTEGRATED FACILITY ENGINEERING

Potential Benefits of
Internet-Based Project Control Systems –
A Study on Change Order Processing
Appendix C

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APPENDIX C. CHANGE ORDER PROCESS ANALYSIS AND RESULTS

This section describes the analysis and results we obtained from the change order process model. We first present the single parameter results, followed by the multi-parameter results.

C.1. Results of Change Order Analysis - Single Parameter

This section presents an overview of how each dimension varies as a function of each parameter in the change order process modeled.

C.1.1. Overall Process Analysis Results
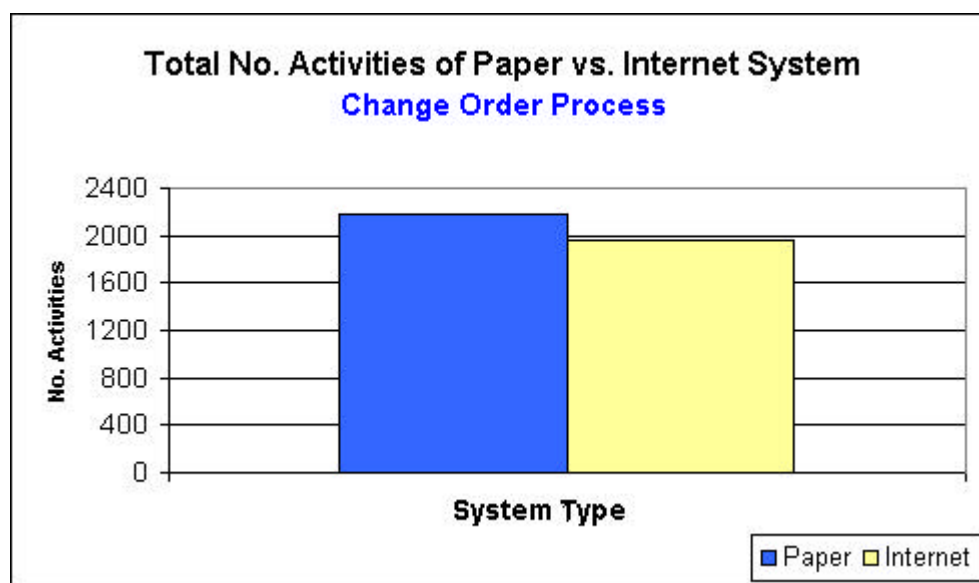
C.1.1.1. Total Number of Activities

How many activities would the project participants perform in the change order process with the paper-based system vs. with an internet-based system?

Paper-based process

- The total process consisted of 2188 activities per change order process.

Internet-based process

- The total process would consist of 1953 activities per change order process.

- 235 activities would be eliminated with the internet-based system - a decrease of 11% (Figure C-1-a).

Figure C-1-a. *Comparison of total number of activities in the change order process with the paper-based system vs. an internet-based system.*

System Type	Paper	Internet	% Change
TOTAL Number of activities	2188	1953	-11%

Table C-1-a. *An internet-based system would decrease the total number of activities for the change order process with a paper-based system by 11%.*

Appendix C. Change Order Process Analysis and Results
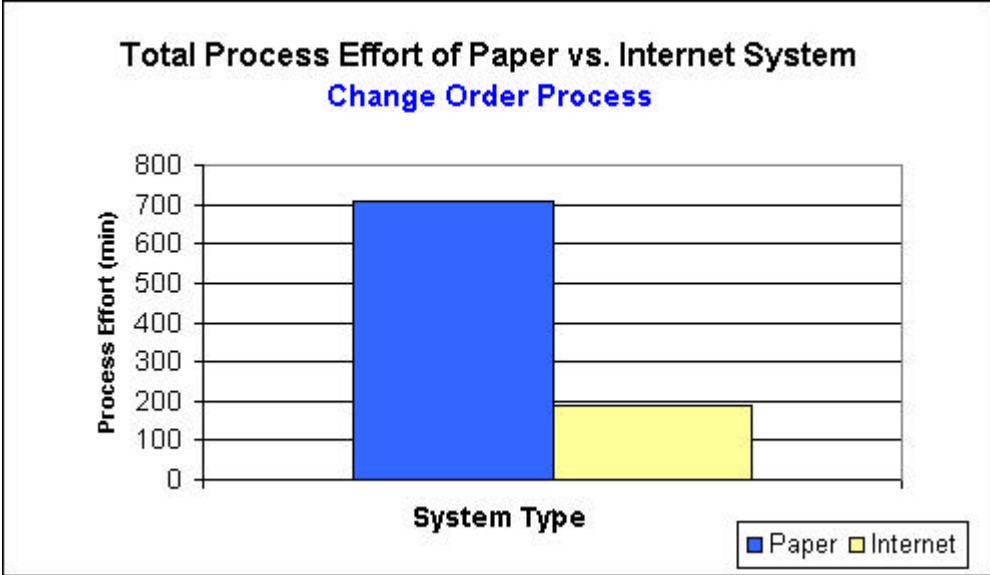
C.1.1.2. Total Processing Effort

How much effort would the project participants expend for the change order process cycle with the paper-based system vs. with an internet-based system? What increase in productivity would this imply?

Paper-based process

- The total processing effort was 707 minutes or approximately 11.8 man-hours per change order cycle.

- Each cycle includes preparation of change order requests, review and negotiation, and issuance of change orders.

Internet-based process

- The total processing effort would be 186 minutes or approximately 3.1 hours per change order cycle.

- The difference in effort is about 74% or an increase in productivity by a factor of 3.8:1 (Figure C-1-b).

Figure C-1-b. *Comparison of total processing effort for change order process cycle with the paper-based system vs. an internet-based system.*

System Type	Paper (min)	Internet (min)	% Change
TOTAL Processing Effort	707	186	-74%

Table C-1-b. *An internet-based system would decrease the total processing effort to process change orders with a paper-based system by 74% – an increase in overall productivity of 3.8.*

Appendix C. Change Order Process Analysis and Results

C.1.1.3. Total Calendar Time

How many days did the project participants take to process change orders with the paper-based system vs. with the internet-based system? What decrease in overall process duration would this imply?

Paper-based process

- In this case study, the change order process spanned a period of approximately 5 months (see Figure C-1-c).

- Although perhaps not obvious from this schedule, the main reason for the delay is because the General Contractor had a backlog of paperwork due to the nature and inherent inefficiencies of the paper-based systems. This is evident twice in this schedule.

    - First, although the WI sub submitted his initial Change Order Request (COR) on December 23, 1997, the GC did not get time to review it until mid February. The GC requested time cards to substantiate the amount requested in the COR. This is the delay between transaction "S51 - Prepare WI COR" and "S51 - Revise WI COR".

    - Again, although the GC received the COR on February 23, 1998, the GC did not have time to process it until late in April 1998. This is the delay between "G51 - Receive WI COR" and "G52 - Prepare OCOR".

- The duration between transaction "G52 - Prepare OCOR" and "S54 - Post SCO" is approximately 1 month.
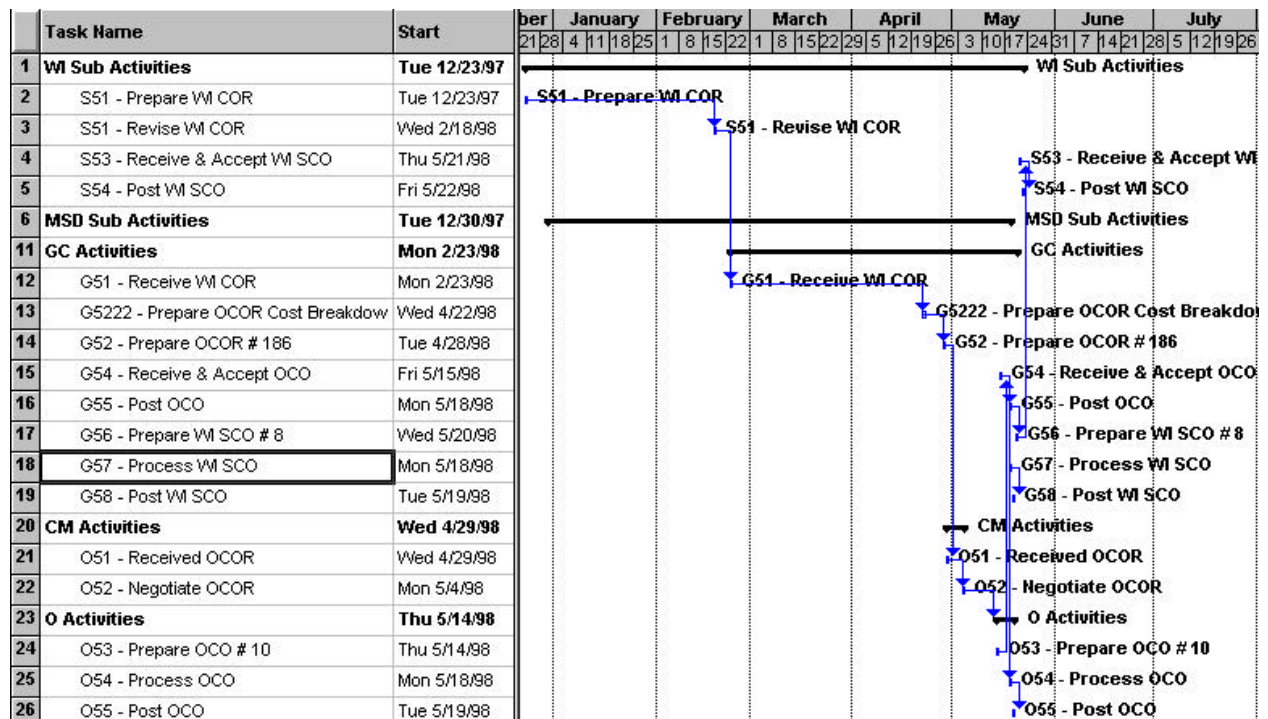

Figure C-1-c. *Calendar time for the change order process with the paper-based system. The duration between management activities "G52 - Prepare OCOR" and "S54 - Post SCO" would be approximately 1 month.*
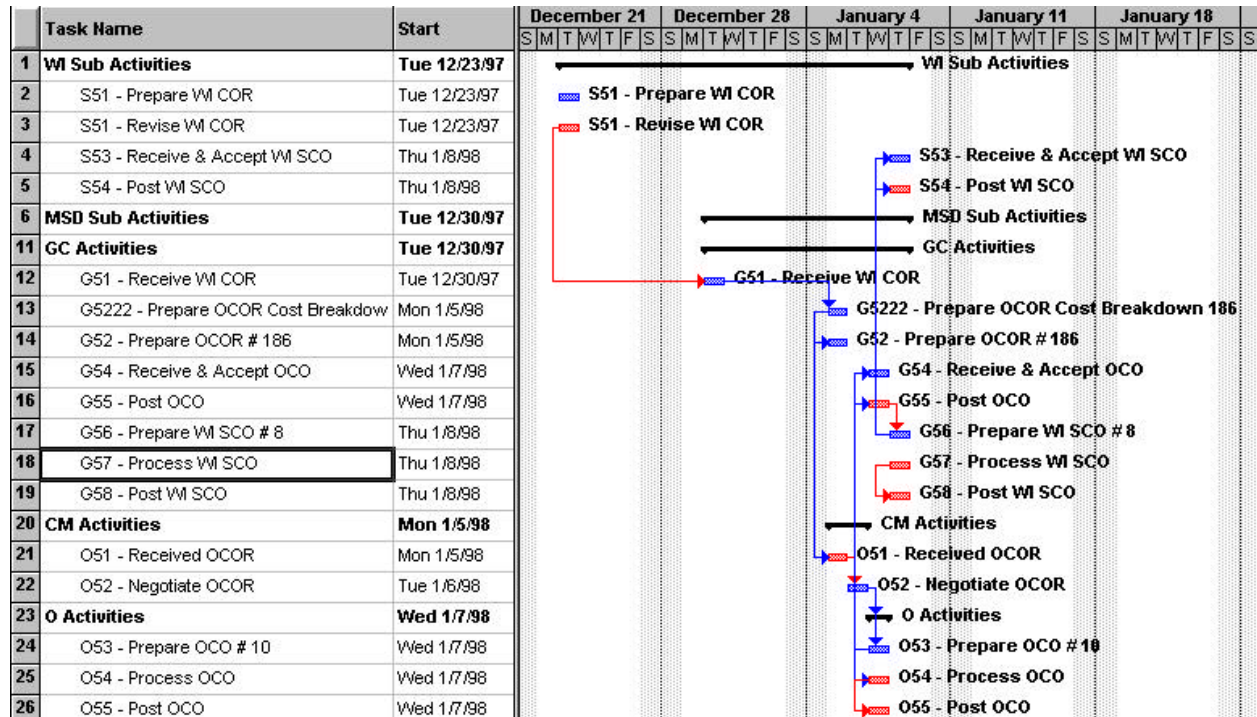
Internet-based process

- We assume the internet-based system would have forced the WI sub to include the time cards, thus the need to revise it would have been eliminated.

- We assume the internet-based system would allow the GC to be current on all document processing and

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therefore backlog should be minimal or at most 1 working day.

- Therefore, the duration between transaction "G52 - Prepare OCOR" and "S54 - Post SCO" could be approximately 1 week, since many transactions would be completely automated (Figure C-1-d).

- This would be a savings of approximately 75% in calendar processing time!

	Task Name	Start
1	WI Sub Activities	Tue 12/23/97
2	S51 - Prepare WI COR	Tue 12/23/97
3	S51 - Revise WI COR	Tue 12/23/97
4	S53 - Receive & Accept WI SCO	Thu 1/8/98
5	S54 - Post WI SCO	Thu 1/8/98
6	MSD Sub Activities	Tue 12/30/97
11	GC Activities	Tue 12/30/97
12	G51 - Receive WI COR	Tue 12/30/97
13	G5222 - Prepare OCOR Cost Breakdow	Mon 1/5/98
14	G52 - Prepare OCOR # 186	Mon 1/5/98
15	G54 - Receive & Accept OCO	Wed 1/7/98
16	G55 - Post OCO	Wed 1/7/98
17	G56 - Prepare WI SCO # 8	Thu 1/8/98
18	G57 - Process WI SCO	Thu 1/8/98
19	G58 - Post WI SCO	Thu 1/8/98
20	CM Activities	Mon 1/5/98
21	O51 - Received OCOR	Mon 1/5/98
22	O52 - Negotiate OCOR	Tue 1/6/98
23	O Activities	Wed 1/7/98
24	O53 - Prepare OCO # 10	Wed 1/7/98
25	O54 - Process OCO	Wed 1/7/98
26	O55 - Post OCO	Wed 1/7/98

Figure C-1-d. *Calendar time for the change order process with an internet-based system. The duration between management activities "G52 - Prepare OCOR" and "S54 - Post SCO" would be approximately 1 week. This would be a savings of almost 75% in calendar processing time!*

C.1.2. Analysis Results per Transaction

The Change Order process consists of many sets of transactions beginning with a subcontractor submitting a Sub Change Order Request and ending with the General Contractor issuing and executing a change order. The following charts have been broken down by the major transaction sets that are representative of the logical sequence of events.

C.1.2.1. Transactions per Organization & Position

What transactions does each project organization and actor perform in the change order process for the paper-based system vs. an internet-based system? How many handoffs exist?

S51 - Process Sub Change Order Request:

- The subcontractor performs the following transactions:

		Paper-Based System	Internet-Based System
Transaction	Description	Actor	Actor
S511 -	Select Sub Change Order Request (SCOR) Issue	Sub Project Manager	Sub Project Manager
S512 -	Find All Relevant Supporting Documents	Sub Project Manager	Sub Project Manager
S513 -	Prepare Sub Change Order Request	Sub Project Manager	Sub Project Manager
S514 -	Log SCOR in Sub's SCOR Log	Sub Project Manager	Sub Project Manager
S515 -	Copy SCOR (before sending to GC)	Sub Clerk	-
S516 -	Send SCOR to GC	Sub Clerk	Sub Project Manager
S517 -	Archive SCOR in Sub's SCOR Folder	Sub Clerk	-

G51 - Process Sub Change Order Request:

- The general contractor (GC) performs the following transactions:

		Paper-Based System	Internet-Based System
Transaction	Description	Actor	Actor
G511 -	Receive Sub Change Order Request (SCOR)	GC Field Clerk	GC Project Accountant
G512 -	Log SCOR in GC's SCOR Log	GC Project Accountant	GC Project Accountant
G513 -	Archive SCOR (temporarily until processed)	GC Field Clerk	-

G52 - Prepare Owner Change Order Request:

- The GC performs the following transactions:

Transaction	Description	Paper-Based System Actor	Internet-Based System Actor
G521 -	Select Owner Change Order Request (OCOR) Issue	GC Project Accountant	GC Project Accountant
G522 -	Find All Relevant Supporting Documents	GC Project Accountant	GC Project Accountant
G523 -	Prepare Owner Change Order Request	GC Project Accountant & GC Project Manager	GC Project Accountant & GC Project Manager
G524 -	Log OCOR in GC's OCOR Log	GC Project Accountant	GC Project Manager
G525 -	Copy OCOR (before sending to Owner)	GC Field Clerk	GC Project Manager
G526 -	Send OCOR to Owner	GC Field Clerk	GC Project Manager
G527 -	Archive OCOR in GC's OCOR Folder	GC Field Clerk	GC Project Manager

O51 - Process Owner Change Order Request:

- The Construction Manager (CM) who represents the Owner performs the following transactions:

Transaction	Description	Paper-Based System Actor	Internet-Based System Actor
O511 -	Receive Owner Change Order Request (OCOR)	CM Field Clerk	CM Project Manager
O512 -	Log OCOR in O's OCOR Log	CM Project Manager	CM Project Manager
O513 -	Review OCOR	CM Project Manager	CM Project Manager
O514 -	Respond to OCOR	CM Project Manager	CM Project Manager

S52, G53, O52 - Negotiate Owner Change Order Request:

- If the Owner Change Order Request is not approved as submitted, the project participants may need to meet to negotiate any unresolved issues until appropriate responsibility and compensation are agreed upon.

Transaction	Description	Paper-Based System Actor	Internet-Based System Actor
S52 -	Negotiate Sub Change Order Request (SCOR)	Sub Project Manager	Sub Project Manager

Transaction	Description		
G53 -	Negotiate Owner Change Order Request (OCOR)	GC Project Manager	GC Project Manager
O52 -	Negotiate Owner Change Order Request (OCOR)	CM Project Manager	CM Project Manager

O53 - Prepare Owner Change Order (Home Office):

- The Owner (O) performs the following transactions:

		Paper-Based System	**Internet-Based System**
Transaction	**Description**	**Actor**	**Actor**
O531 -	Prepare Owner Change Order (OCO)	O Project Accountant	O Project Manager
O532 -	Review & Approve OCO (before sending to GC)	O Project Manager	O Project Manager
O533 -	Log OCO in O's OCOR Log	O Project Accountant	O Project Manager
O534 -	Send OCO to GC	O Home Office Clerk	O Project Manager

G54 - Process Owner Change Order (Field Office):

- The GC performs the following transactions:

		Paper-Based System	**Internet-Based System**
Transaction	**Description**	**Actor**	**Actor**
G541 -	Receive Owner Change Order (OCO)	GC Field Clerk	GC Project Manager
G542 -	Accept OCO	GC Project Manager	GC Project Manager
G543 -	Log OCO in GC's OCOR Log	GC Project Accountant	GC Project Manager
G544 -	Log OCO in O-GC-S CO Log	GC Project Accountant	GC Project Manager
G545 -	Log OCO in GC's SCOR Log	GC Project Accountant	GC Project Manager
G546 -	Return OCO to Owner	GC Field Clerk	GC Project Manager
G547 -	Copy OCO	GC Field Clerk	-
G548 -	Send OCO to GC Accounting	GC Field Clerk	GC Project Manager
G549 -	Archive OCO in GC's OCO Folder	GC Field Clerk	-

O54 - Process Owner Change Order (Field Office):

- The Owner (O) performs the following transactions:

Transaction	Description	Paper-Based System Actor	Internet-Based System Actor
O541 -	Receive Owner Change Order (accepted)	O Home Office Clerk	O Project Manager
O542 -	Execute OCO	O Project Manager	O Project Manager
O543 -	Update O's OCOR Log	O Project Accountant	O Project Manager
O544 -	Copy OCO	O Home Office Clerk	-
O545 -	Send OCO	O Home Office Clerk	O Project Manager
O546 -	Archive OCO in O's OCO Folder	O Home Office Clerk	-

O55 - Process Owner Change Order (Home Office):

- The Owner (O) performs the following transactions:

Transaction	Description	Paper-Based System Actor	Internet-Based System Actor
O551 -	Receive Owner Change Order	O Home Office Clerk	O Project Manager
O552 -	Post OCO in Accounting Database	O Accounting Entry	O Project Manager
O553 -	Archive OCO in O's OCO Folder	O Home Office Clerk	-

G55 - Process Owner Change Order (Home Office):

- The General Contractor (GC) performs the following transactions:

Transaction	Description	Paper-Based System Actor	Internet-Based System Actor
G551 -	Receive Owner Change Order	GC Home Office Clerk	GC Project Manager
G552 -	Post OCO in Accounting Database for Billing	GC Accounting Entry	GC Project Manager
G553 -	Archive OCO in GC's OCO Folder	GC Home Office Clerk	-

G56 - Prepare Sub Change Order (Field Office):

- The GC performs the following transactions:

		Paper-Based System	Internet-Based System
Transaction	**Description**	**Actor**	**Actor**
G561 -	Prepare Sub Change Order (SCO)	GC Project Accountant	GC Project Accountant
G562 -	Review & Approve SCO (before sending to Sub)	GC Project Manager	GC Project Manager
G563 -	Log SCO in GC's SCOR Log	GC Project Accountant	GC Project Manager
G564 -	Send SCO to Sub	GC Field Clerk	GC Project Manager

S53 - Receive & Accept Sub Change Order (Field Office):

- The Sub performs the following transactions:

		Paper-Based System	Internet-Based System
Transaction	**Description**	**Actor**	**Actor**
S531 -	Receive Sub Change Order (SCO)	Sub Field Clerk	Sub Project Manager
S532 -	Accept SCO	Sub Project Manager	Sub Project Manager
S533 -	Log SCO in Sub's SCOR Log	Sub Project Manager	Sub Project Manager
S534 -	Copy SCO	Sub Field Clerk	-
S535 -	Return SCO (accepted) to GC	Sub Field Clerk	Sub Project Manager
S536 -	Send SCO to GC Accounting	Sub Field Clerk	Sub Project Manager
S537 -	Archive SCO in Sub's SCO Folder	Sub Field Clerk	-

G57 - Process Sub Change Order (Home Office):

- The General Contractor (GC) performs the following transactions:

		Paper-Based System	Internet-Based System
Transaction	**Description**	**Actor**	**Actor**
G571 -	Receive Sub Change Order (accepted)	GC Home Office Clerk	GC Project Manager
G572 -	Execute SCO	GC Project Manager	GC Project Manager

G573 -	Update GC's SCOR Log	GC Project Accountant	GC Project Manager
G574 -	Updated O-GC-S CO Log	GC Project Accountant	GC Project Manager
G575 -	Copy SCO	GC Home Office Clerk	-
G576 -	Send SCO to GC Accounting	GC Home Office Clerk	GC Project Manager
G577 -	Archive SCO in GC's SCO Folder	GC Home Office Clerk	-

G58 - Process Sub Change Order (Home Office):

- The General Contractor (GC) performs the following transactions:

		Paper-Based System	**Internet-Based System**
Transaction	**Description**	**Actor**	**Actor**
G581 -	Receive Sub Change Order (SCO)	GC Home Office Clerk	GC Project Manager
G582 -	Post SCO in Accounting Database (for Payment)	GC Accounting Entry	GC Project Manager
G583 -	Archive SCO in GC's SCO Folder	GC Home Office Clerk	-

S54 - Process Sub Change Order (Home Office):

- The Subcontractor (S) performs the following transactions:

		Paper-Based System	**Internet-Based System**
Transaction	**Description**	**Actor**	**Actor**
S541 -	Receive Sub Change Order	Sub Home Office Clerk	Sub Project Manager
S542 -	Post SCO in Accounting Database for Billing	Sub Accounting Entry	Sub Project Manager
S543 -	Archive SCO in Sub's SCO Folder	Sub Home Office Clerk	-

Paper-based process

In the paper-based system, a total of 13 people, or 2-4 actors per organization, are needed to prepare and process the change order documents. There are at least 47 hand-offs of the change order documents between project participants.

Internet-based process

In the internet-based system, only 5 people, or 1-2 actors per organization are needed to prepare and process change orders. There are only 12 hand-offs of the change order documents between project participants. More direct communication by excluding intermediaries may be one of the greatest factors that will enable the expected savings of 74% in process time and process effort.

C.1.2.2. Number of Activities and Process Effort per Transaction

S51 & G51 - Process Sub Change Order Request (MSD Sub):

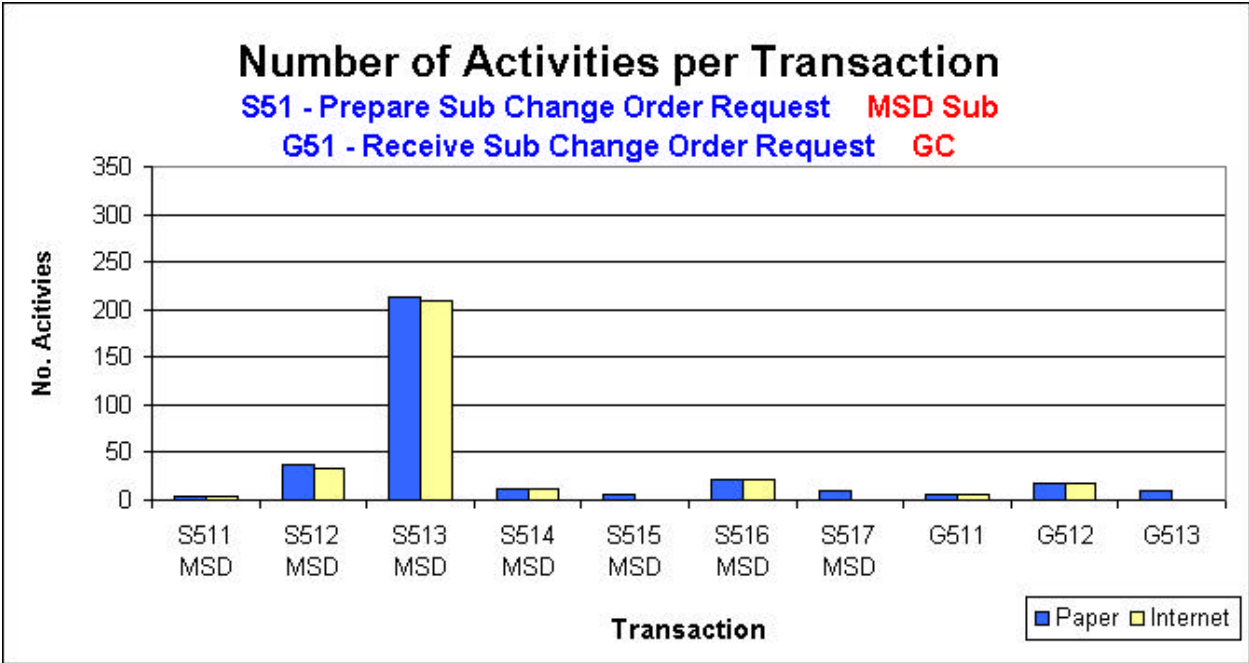*C.1.2.2.1. Number of Activities per Transaction*

How many activities are included in each transaction to prepare & process the MSD Sub Change Order Request with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "S511 - Select SCOR Issue" includes 4 activities or 0.2% of the total activities.

- Transaction "S512 - Find All Relevant Supporting Documents" includes 37 activities or 1.7% of the total activities.

- Transaction "S513 - Prepare Sub Change Order Request" includes 213 activities or 9.7% of the total activities.

- Transaction "S514 - Log SCOR in Sub's SCOR Log" includes 12 activities or 0.5% of the total activities.

- Transaction "S515 - Copy SCOR" includes 6 activities or 0.3% of the total activities.

- Transaction "S516 - Send SCOR to GC" includes 21 activities or 1% of the total activities.

- Transaction "S517 - Archive SCOR in Sub SCOR Folder" includes 10 activities or 0.5% of the total activities.

- Transaction "G511 - GC Receive SCOR (MSD Sub)" includes 6 activities or 0.3% of the total activities.

- Transaction "G512 - Log SCOR in GC's SCOR Log" includes 17 activities or 0.8% of the total activities.

- Transaction "G513 - Archive SCOR (temporarily until processed)" includes 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions include the same number of activities as in the paper-based system.

- The main exceptions are transactions "S515", "S517" and "G513" since the work to copy and archive change orders would be eliminated with the internet-based system (Figure C-2-a).

Figure C-2-a. *Comparison of activities per transaction to prepare & process the MSD Sub Change Order Request with the paper-based system vs. an internet-based system.*

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Transaction	Paper	% of Activities	Internet	% of Activities
S511 - Select SCOR Issue	4	0.2%	4	0.2%
S512 - Find Supporting Documents	37	1.7%	34	1.7%
S513 - Prepare SCOR (MSD Sub)	213	9.7%	210	10.8%
S514 - Log SCOR in SCOR Log	12	0.5%	12	0.6%
S515 - Copy SCOR	6	0.3%	0	0.0%
S516 - Send SCOR to GC	21	1.0%	21	1.1%
S517 - Archive SCOR	10	0.5%	0	0.0%
G511 - Receive SCOR	6	0.3%	6	0.3%
G512 - Log SCOR in SCOR Log	17	0.8%	17	0.9%
G513 - Archive SCOR	10	0.5%	0	0.0%
TOTAL Number of activities	336	15%	304	16%

Table C-2-a. *Distribution of activities per transaction for each type of system.*

C.1.2.2.2. Processing Effort per Transaction

How much effort would each transaction take to prepare & process the MSD Sub Change Order Request with the paper-based system vs. with an internet-based system?

S51 & G51 - Process Sub Change Order Request (MSD Sub):

Paper-based process

- Transaction "S511 - Select SCOR Issue" took 1 minute or 0.1% of the total processing effort..

- Transaction "S512 - Find All Relevant Supporting Documents" took 8 minutes or 1.1% of the total effort.

- Transaction "S513 - Prepare Sub Change Order Request" took 49 minutes or 7.0% of the total processing effort.

- Transaction "S514 - Log SCOR in Sub's SCOR Log" took 2 minutes or 0.2% of the total processing effort.

- Transaction "S515 - Copy SCOR" took 2 minutes or 0.2% of the total processing effort.

- Transaction "S516 - Send SCOR to GC" took 3 minutes or 0.4% of the total processing effort.

- Transaction "S517 - Archive SCOR in Sub SCOR Folder" took 1 minute or 0.1% of the total processing effort.

- Transaction "G511 - GC Receive SCOR (MSD Sub)" took 1 minute or 0.1% of the total processing effort.

- Transaction "G512 - Log SCOR in GC's SCOR Log" took 3 minutes or 0.5% of the total processing effort.

- Transaction "G513 - Archive SCOR (temporarily until processed)" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "S513 - Prepare Sub Change Order Request" would take 19 minutes or 10.2% of the total processing effort. This is a reduction of 62% in processing effort.

- Transaction "G512 - Log SCOR in GC's SCOR Log" would take 1 minute or 0.5% of the total processing effort. This is a reduction of 70% in processing effort.

- All other transactions would take 0 minutes because they are either automated by the internet-based system or are completely eliminated from the process (Figure C-2-b).
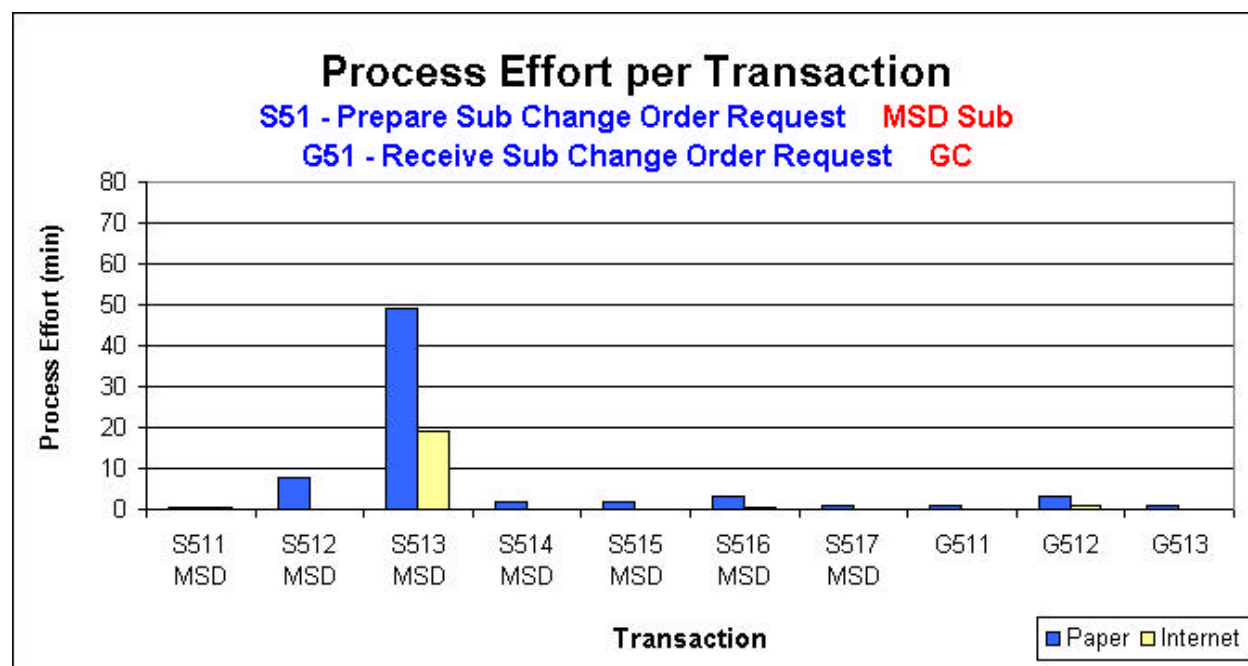
Figure C-2-b. *Comparison of processing effort per transaction to prepare & process the MSD Sub Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
S511 - Select SCOR Issue	1	0.1%	0	0.2%
S512 - Find Supporting Documents	8	1.1%	0	0.0%
S513 - Prepare SCOR (MSD Sub)	49	7.0%	19	10.2%
S514 - Log SCOR in SCOR Log	2	0.2%	0	0.0%
S515 - Copy SCOR	2	0.2%	0	0.0%
S516 - Send SCOR to GC	3	0.4%	0	0.1%
S517 - Archive SCOR	1	0.1%	0	0.0%
G511 - Receive SCOR	1	0.1%	0	0.0%
G512 - Log SCOR in SCOR Log	3	0.5%	1	0.5%
G513 - Archive SCOR	1	0.1%	0	0.0%
TOTAL Processing Effort	70	10%	21	11%

Table C-2-b. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
S511 - Select SCOR Issue	1	0	-50%
S512 - Find Supporting Documents	8	0	-100%
S513 - Prepare SCOR (MSD Sub)	49	19	-62%
S514 - Log SCOR in SCOR Log	2	0	-100%
S515 - Copy SCOR	2	0	-100%
S516 - Send SCOR to GC	3	0	-92%
S517 - Archive SCOR	1	0	-100%
G511 - Receive SCOR	1	0	-100%
G512 - Log SCOR in SCOR Log	3	1	-70%
G513 - Archive SCOR	1	0	-100%
TOTAL Processing Effort	70	21	-71%

Table C-2-c. *Percentage decrease in processing effort per transaction due to an internet-based system.*

S51 & G51 - Process Sub Change Order Request (WI Sub):

C.1.2.2.3. Number of Activities per Transaction

How many activities are included in each transaction to prepare & process the WI Sub Change Order Request with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "S511 - Select SCOR Issue" included 4 activities or 0.2% of the total activities.

- Transaction "S512 - Find All Relevant Supporting Documents" included 102 activities or 4.7% of the total activities.

- Transaction "S513 - Prepare Sub Change Order Request" included 309 activities or 14.1% of the total activities.

- Transaction "S514 - Log SCOR in Sub's SCOR Log" included 12 activities or 0.5% of the total activities.

- Transaction "S515 - Copy SCOR" included 12 activities or 0.5% of the total activities.

- Transaction "S516 - Send SCOR to GC" included 21 activities or 1% of the total activities.

- Transaction "S517 - Archive SCOR in Sub SCOR Folder" included 10 activities or 0.5% of the total activities.

- Transaction "G511 - GC Receive SCOR (WI Sub)" included 6 activities or 0.3% of the total activities.

- Transaction "G512 - Log SCOR in GC's SCOR Log" included 17 activities or 0.8% of the total activities.

- Transaction "G513 - Archive SCOR (temporarily until processed)" included 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions include the same number of activities as in the paper-based system.

- The main exceptions are transactions "S515", "S517" and "G513" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-c).
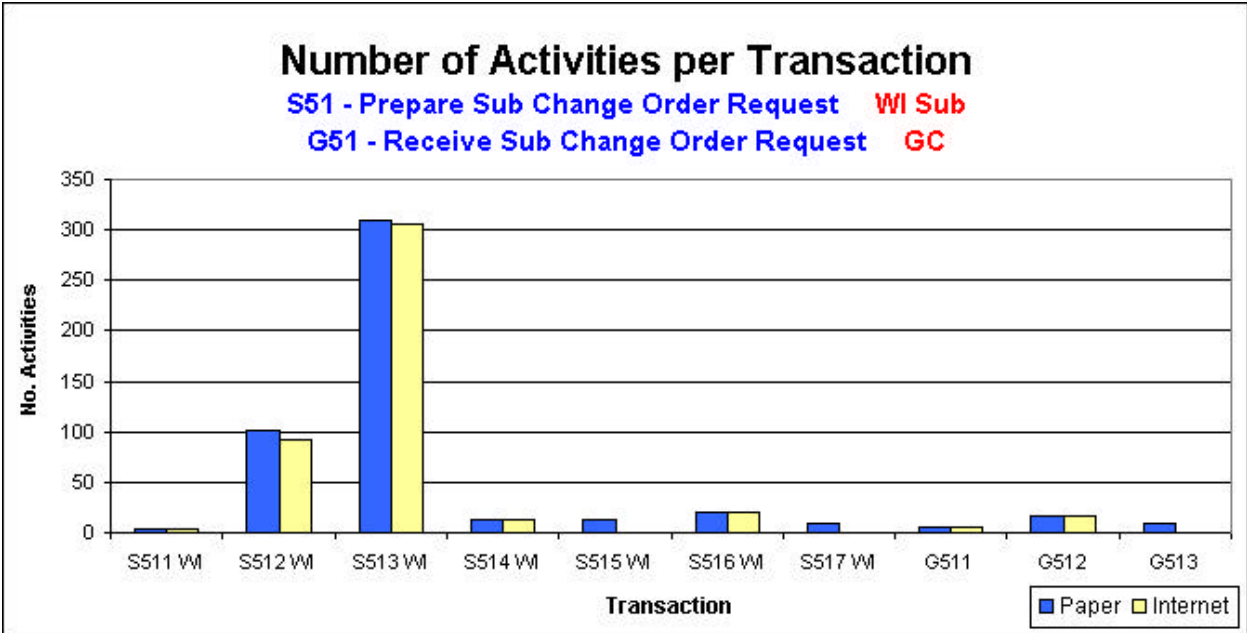

Figure C-2-c. *Comparison of activities per transaction to prepare & process the WI Sub Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
S511 - Select SCOR Issue	4	0.2%	4	0.2%
S512 - Find Supporting Documents	102	4.7%	93	4.8%
S513 - Prepare SCOR (WI Sub)	309	14.1%	306	15.7%
S514 - Log SCOR in SCOR Log	12	0.5%	12	0.6%
S515 - Copy SCOR	12	0.5%	0	0.0%
S516 - Send SCOR to GC	21	1.0%	21	1.1%
S517 - Archive SCOR	10	0.5%	0	0.0%
G511 - Receive SCOR	6	0.3%	6	0.3%
G512 - Log SCOR in SCOR Log	17	0.8%	17	0.9%
G513 - Archive SCOR	10	0.5%	0	0.0%
TOTAL Number of activities	503	23%	459	24%

Table C-2-d. *Distribution of activities per transaction for each type of system.*

C.1.2.2.4. Processing Effort per Transaction

How much effort would each transaction take to prepare & process the WI Sub Change Order Request with the paper-based system vs. with an internet-based system?

S51 & G51 - Process Sub Change Order Request (WI Sub):

Paper-based process

- Transaction "S511 - Select SCOR Issue" took 1 minute or 0.1% of the total processing effort.

- Transaction "S512 - Find All Relevant Supporting Documents" took 24 minutes or 3.4% of the total effort.

- Transaction "S513 - Prepare Sub Change Order Request" took 68 minutes or 9.5% of the total processing effort.

- Transaction "S514 - Log SCOR in Sub's SCOR Log" took 2 minutes or 0.2% of the total processing effort.

- Transaction "S515 - Copy SCOR" took 3 minutes or 0.5% of the total processing effort.

- Transaction "S516 - Send SCOR to GC" took 3 minutes or 0.4% of the total processing effort.

- Transaction "S517 - Archive SCOR in Sub SCOR Folder" took 1 minute or 0.1% of the total processing effort.

- Transaction "G511 - GC Receive SCOR (MSD Sub)" took 1 minute or 0.1% of the total processing effort.

- Transaction "G512 - Log SCOR in GC's SCOR Log" took 3 minutes or 0.5% of the total processing effort.

- Transaction "G513 - Archive SCOR (temporarily until processed)" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "S513 - Prepare Sub Change Order Request" would take 19 minutes or 10.1% of the total processing effort. This is a reduction of 72% in processing effort.

- Transaction "G512 - Log SCOR in GC's SCOR Log" would take 1 minute or 0.5% of the total processing effort. This is a reduction of 70% in processing effort.

- All other transactions would take 0 minutes because they are either automated by the internet-based system or are completely eliminated from the process (Figure C-2-d).
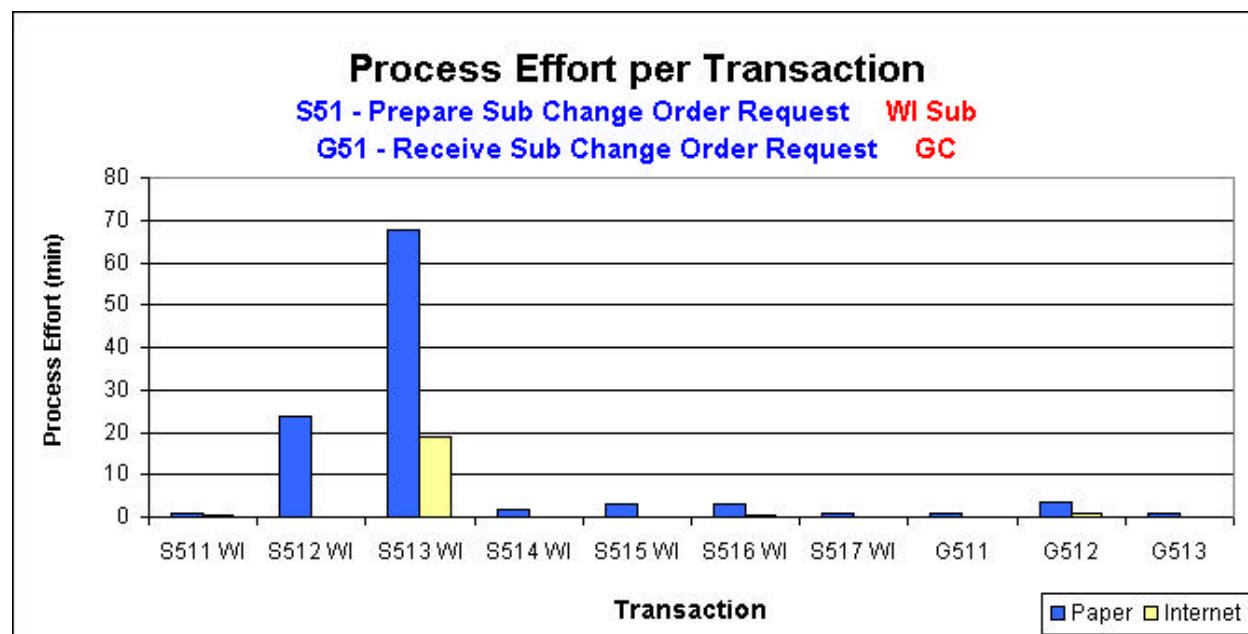
Figure C-2-d. *Comparison of processing effort per transaction to prepare & process the WI Sub Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
S511 - Select SCOR Issue	1	0.1%	0	0.2%
S512 - Find Supporting Documents	24	3.4%	0	0.0%
S513 - Prepare SCOR (WI Sub)	68	9.5%	19	10.1%
S514 - Log SCOR in SCOR Log	2	0.2%	0	0.0%
S515 - Copy SCOR	3	0.5%	0	0.0%
S516 - Send SCOR to GC	3	0.4%	0	0.1%
S517 - Archive SCOR	1	0.1%	0	0.0%
G511 - Receive SCOR	1	0.1%	0	0.0%
G512 - Log SCOR in SCOR Log	3	0.5%	1	0.5%
G513 - Archive SCOR	1	0.1%	0	0.0%
TOTAL Processing Effort	106	15%	20	11%

Table C-2-e. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
S511 - Select SCOR Issue	1	0	-50%
S512 - Find Supporting Documents	24	0	-100%
S513 - Prepare SCOR (MSD Sub)	68	19	-72%
S514 - Log SCOR in SCOR Log	2	0	-100%
S515 - Copy SCOR	3	0	-100%
S516 - Send SCOR to GC	3	0	-92%
S517 - Archive SCOR	1	0	-100%
G511 - Receive SCOR	1	0	-100%
G512 - Log SCOR in SCOR Log	3	1	-70%
G513 - Archive SCOR	1	0	-100%
TOTAL Processing Effort	106	20	-81%

Table C-2-f. *Percentage decrease in processing effort per transaction due to an internet-based system.*

68

G52 & O51 - Prepare & Process Owner Change Order Request (OCOR):

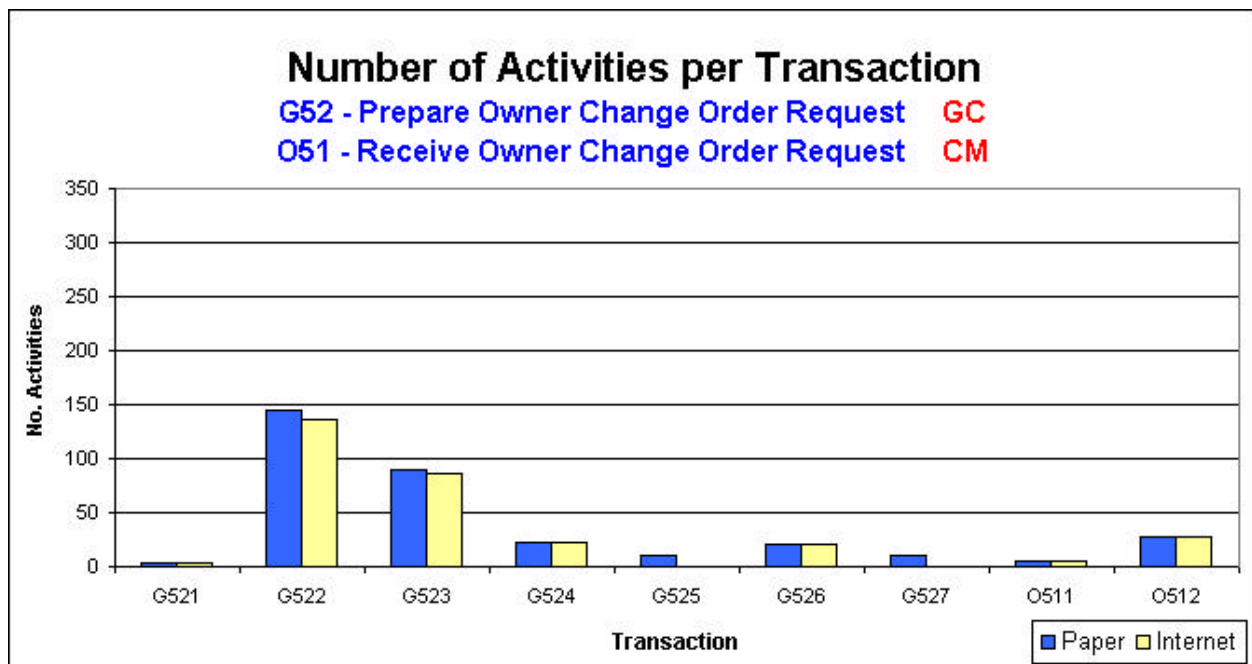*C.1.2.2.5. Number of Activities per Transaction*

How many activities are included in each transaction to prepare & process the Owner Change Order Request with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "G521 - Select OCOR Issue" included 4 activities or 0.2% of the total activities.

- Transaction "G522 - Find All Relevant Supporting Documents" included 144 activities or 6.6% of the total activities.

- Transaction "G523 - Prepare Owner Change Order Request" included 89 activities or 4.1% of the total activities.

- Transaction "G524 - Log OCOR in GC's OCOR Log" included 23 activities or 1.1% of the total activities.

- Transaction "G525 - Copy OCOR" included 10 activities or 0.5% of the total activities.

- Transaction "G526 - Send OCOR to Owner" included 21 activities or 1% of the total activities.

- Transaction "G527 - Archive OCOR in GC's OCOR Folder" included 10 activities or 0.5% of the total activities.

- Transaction "O511 - CM Receive OCOR" included 6 activities or 0.3% of the total activities.

- Transaction "O512 - Log OCOR in O's OCOR Log" included 27 activities or 1.2% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- The main exceptions are transactions "G525" and "G527" since the work to copy and archive change orders would be eliminated with the internet-based system (Figure C-2-e).

Figure C-2-e. *Comparison of activities per transaction to prepare & process the Owner Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
G521 - Select OCOR Issue	4	0.2%	4	0.2%
G522 - Find Supporting Documents	144	6.6%	137	7.0%
G523 - Prepare OCOR	89	4.1%	87	4.5%
G524 - Log OCOR in OCOR Log	23	1.1%	23	1.2%
G525 - Copy OCOR	10	0.5%	0	0.0%
G526 - Send OCOR to GC	21	1.0%	21	1.1%
G527 - Archive OCOR	10	0.5%	0	0.0%
O511 - Receive OCOR	6	0.3%	6	0.3%
O512 - Log OCOR in OCOR Log	27	1.2%	27	1.4%
TOTAL Number of activities	334	15%	305	16%

Table C-2-g. *Distribution of activities per transaction for each type of system.*

C.1.2.2.6. Processing Effort per Transaction

How much effort would each transaction take to prepare & process the Owner Change Order Request with the paper-based system vs. with an internet-based system?

G52 & O51 - Prepare & Process Owner Change Order Request (OCOR):

Paper-based process

- Transaction "G521 - Select OCOR Issue" would take 1 minute or 0.1% of the total processing effort.

- Transaction "G522 - Find All Relevant Supporting Documents" would take 50 minutes or 7.1% of the total effort.

- Transaction "G523 - Prepare Owner Change Order Request" includes 28 minutes or 4.0% of the total processing effort.

- Transaction "G524 - Log OCOR in Sub's OCOR Log" includes 2 minutes or 0.3% of the total processing effort.

- Transaction "G525 - Copy OCOR" includes 3 minutes or 0.6% of the total processing effort.

- Transaction "G526 - Send OCOR to GC" includes 3 minutes or 0.5% of the total processing effort.

- Transaction "G527 - Archive SCOR in Sub SCOR Folder" includes 1 minute or 0.1% of the total processing effort.

- Transaction "O511 - GC Receive SCOR (MSD Sub)" includes 1 minute or 0.1% of the total processing effort.

- Transaction "O512 - Log SCOR in GC's SCOR Log" includes 4 minutes or 0.6% of the total processing effort.

Internet-based process

- Transaction "G522 - Find All Relevant Supporting Documents" would take 9 minutes or 5% of the total processing effort. This would be a reduction of 82% in processing effort.

- Transaction "G523 - Prepare Sub Change Order Request" would take 18 minutes or 9.7% of the total processing effort. This would be a reduction of 35% in processing effort.

- All other transactions would take 0 minutes because they would be either automated by the internet-based system or completely eliminated from the process (Figure C-2-f).
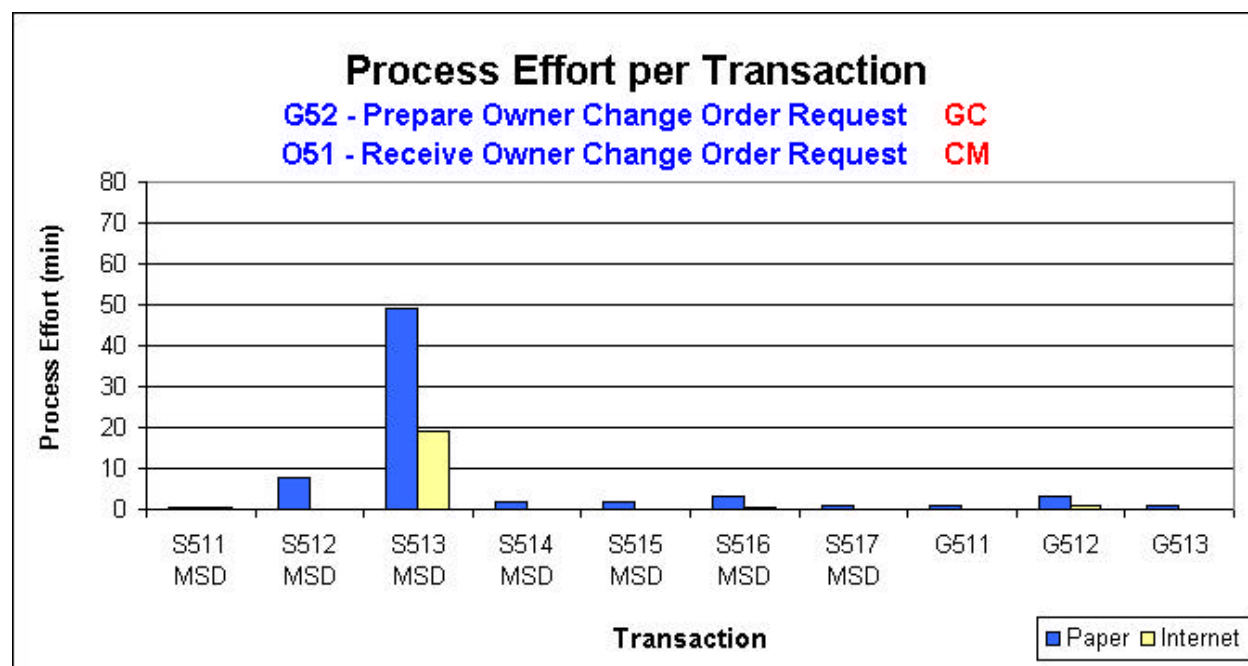
Appendix C. Change Order Process Analysis and Results

Figure C-2-f. *Comparison of processing effort per transaction to prepare & process the Owner Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
G521 - Select OCOR Issue	1	0.2%	1	0.4%
G522 - Find Supporting Documents	50	7.1%	9	5.0%
G523 - Prepare OCOR	28	4.0%	18	9.7%
G524 - Log OCOR in OCOR Log	2	0.3%	0	0.0%
G525 - Copy OCOR	5	0.6%	0	0.0%
G526 - Send OCOR to GC	3	0.5%	0	0.1%
G527 - Archive OCOR	1	0.1%	0	0.0%
O511 - Receive OCOR	1	0.1%	0	0.0%
O512 - Log OCOR in OCOR Log	4	0.6%	0	0.0%
TOTAL Processing Effort	95	13%	28	15%

Table C-2-h. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
G521 - Select OCOR Issue	1	1	-43%
G522 - Find Supporting Documents	50	9	-82%
G523 - Prepare OCOR	28	18	-35%
G524 - Log OCOR in OCOR Log	2	0	-100%
G525 - Copy OCOR	5	0	-100%
G526 - Send OCOR to GC	3	0	-92%
G527 - Archive OCOR	1	0	-100%
O511 - Receive OCOR	1	0	-100%
O512 - Log OCOR in OCOR Log	4	0	-100%
TOTAL Processing Effort	95	28	-70%

Table C-2-i. *Percentage decrease in processing effort per transaction due to an internet-based system.*

O51, S52, G53 & O52 - Approve / Negotiate Owner Change Order Request (OCOR):

C.1.2.2.7. Number of Activities per Transaction

How many activities are included in each transaction to approve / negotiate the Owner Change Order Request with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "O513 - Review & Approve OCOR" includes 3 activities or 0.1% of the total activities.

- Transaction "O514 - Respond to OCOR" includes 4 activities or 0.2% of the total activities.

- Transaction "S52 (MSD Sub) - Negotiate SCOR" includes 1 activity or 0.1% of the total activities.

- Transaction "S52 (WI Sub) - Negotiate SCOR" includes 1 activity or 0.1% of the total activities.

- Transaction "G53 - Negotiate OCOR" includes 1 activity or 0.1% of the total activities.

- Transaction "O52 - Negotiate OCOR" includes 1 activity or 0.1% of the total activities.

Internet-based process

- All transactions include the same number of activities as in the paper-based system.
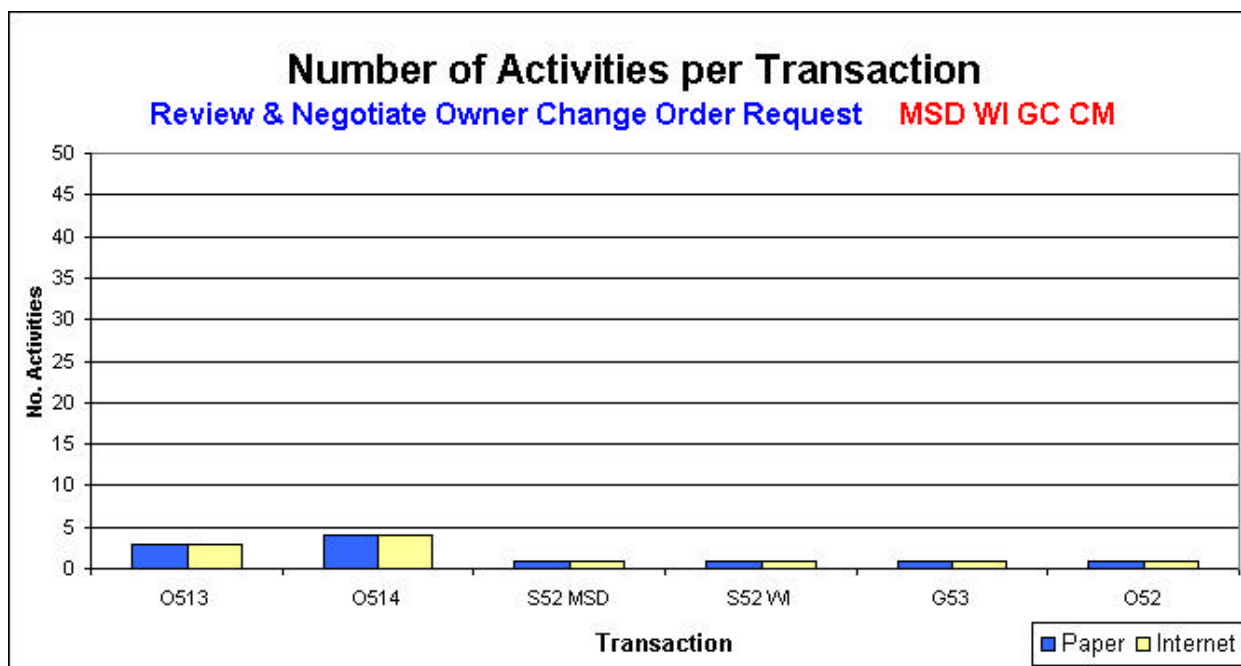
Figure C-2-g. *Comparison of activities per transaction to review / negotiate the Owner Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
O513 - Review & Approve OCOR	3	0.1%	3	0.2%
O514 - Respond to OCOR	4	0.2%	4	0.2%
S52 - Negotiate SCOR (MSD Sub)	1	0.0%	1	0.1%
S52 - Negotiate SCOR (WI Sub)	1	0.0%	1	0.1%
G53 - Negotiate OCOR	1	0.0%	1	0.1%
O52 - Negotiate OCOR	1	0.0%	1	0.1%
TOTAL Number of activities	11	0.5%	11	0.5%

Table C-2-j. *Distribution of activities per transaction for each type of system.*

How much effort would each transaction take to review / negotiate an Owner Change Order Request with the paper-based system vs. with an internet-based system?

O51, S52, G53 & O52 - Approve / Negotiate Owner Change Order Request (OCOR):

Paper-based process

- Transaction "O513 - Review & Approve OCOR" took 15 minutes or 2.1% of the total processing effort.

- Transaction "O514 - Respond to OCOR" took 3 minutes or 0.4% of the total effort.

- Transaction "S52 (MSD Sub) - Negotiate SCOR" included 60 minutes or 8.5% of the total processing effort.

- Transaction "S52 (WI Sub) - Negotiate SCOR" included 60 minutes or 8.5% of the total processing effort.

- Transaction "G53 - Negotiate OCOR" included 60 minutes or 8.5% of the total processing effort.

- Transaction "O52 - Negotiate OCOR" included 60 minutes or 8.5% of the total processing effort.

Internet-based process

- Transaction "O513 - Review & Approve OCOR" would take 15 minutes or 7.8% of the total processing effort. This would be a reduction of 3% in processing effort.

- Transaction "O514 - Respond to OCOR" would take 3 minutes or 1.6% of the total effort. This would be a reduction of 3% in processing effort.

- Transaction "S52 (MSD Sub) - Negotiate SCOR" would take 15 minutes or 8.1% of the total processing effort. This would be a reduction of 75% in processing effort.

- Transaction "S52 (WI Sub) - Negotiate SCOR" would take 15 minutes or 8.1% of the total processing effort. This would be a reduction of 75% in processing effort.

- Transaction "G53 - Negotiate OCOR" would take 15 minutes or 8.1% of the total processing effort. This would be a reduction of 75% in processing effort.

- Transaction "O52 - Negotiate OCOR" would take 15 minutes or 8.1% of the total processing effort. This would be a reduction of 75% in processing effort.

- The negotiations may be held online or in meetings, but are assumed to reduce since the issue will be better documented and there would be less need to negotiate (Figure C-2-h).
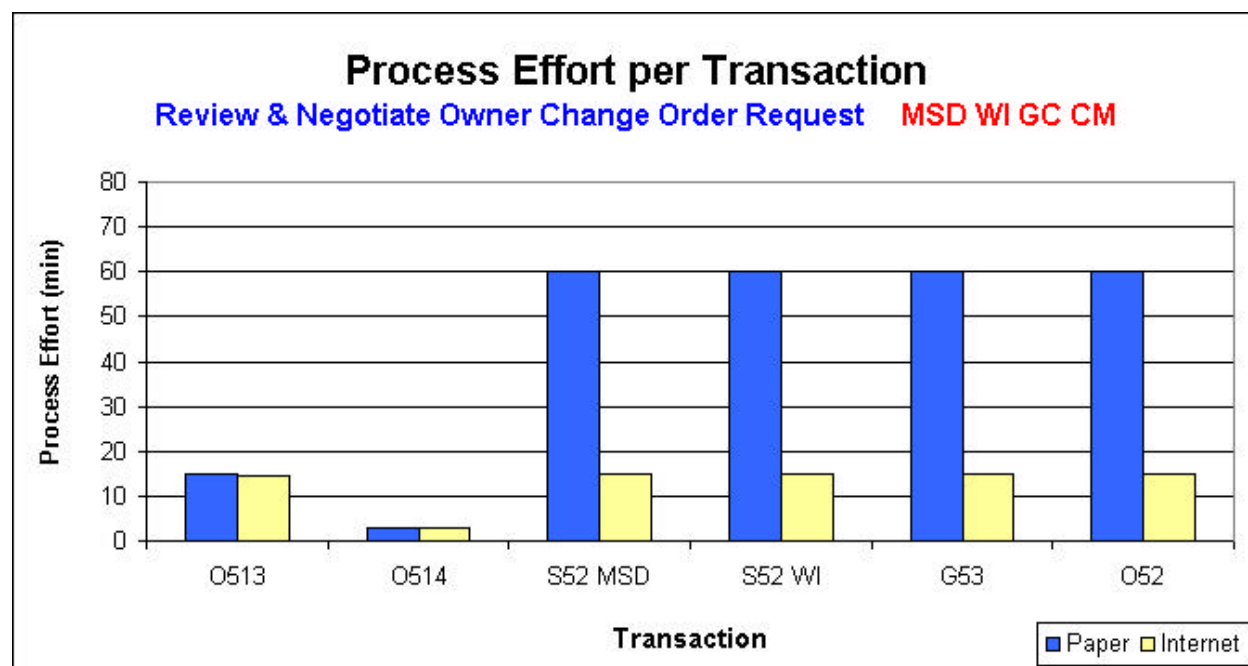
Figure C-2-h. *Comparison of processing effort per transaction to review / negotiate the Owner Change Order Request with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
O513 - Review & Approve OCOR	15	2.1%	15	7.8%
O514 - Respond to OCOR	3	0.4%	3	1.6%
S52 - Negotiate SCOR (MSD Sub)	60	8.5%	15	8.1%
S52 - Negotiate SCOR (WI Sub)	60	8.5%	15	8.1%
G53 - Negotiate OCOR	60	8.5%	15	8.1%
O52 - Negotiate OCOR	60	8.5%	15	8.1%
TOTAL Processing Effort	258	36.5%	77	41.6%

Table C-2-k. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
O513 - Review & Approve OCOR	15	15	-3%
O514 - Respond to OCOR	3	3	-3%
S52 - Negotiate SCOR (MSD Sub)	60	15	-75%
S52 - Negotiate SCOR (WI Sub)	60	15	-75%
G53 - Negotiate OCOR	60	15	-75%
O52 - Negotiate OCOR	60	15	-75%
TOTAL Processing Effort	258	77	-70%

Table C-2-l. *Percentage decrease in processing effort per transaction due to an internet-based system.*

O53 & G54 - Prepare & Accept Owner Change Order:

C.1.2.2.9. Number of Activities per Transaction

How many activities are included in each transaction to approve / negotiate the Owner Change Order Request with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "O531 - Prepare Owner Change Order (OCO)" included 83 activities or 3.8% of the total activities.

- Transaction "O532 - Review & Approve OCO (before sending to GC)" included 2 activities or 0.1% of the total activities.

- Transaction "O533 - Log OCO in O's OCOR Log" included 46 activities or 2.1% of the total activities.

- Transaction "O534 - Send OCO to GC" included 21 activities or 1.0% of the total activities.

- Transaction "G541 - Receive OCO" included 6 activities or 0.3% of the total activities.

- Transaction "G542 - GC Accept OCO" included 6 activities or 0.3% of the total activities.

- Transaction "G543 - Log OCO in GC's OCOR Log" included 48 activities or 2.2% of the total activities.

- Transaction "G544 - Log OCO in O-GC-S CO Log" included 54 activities or 2.5% of the total activities.

- Transaction "G545- Log OCO in GC's SCOR Log" included 14 activities or 0.6% of the total activities.

- Transaction "G546 - Copy OCO" included 1 activity or 0.1% of the total activities.

- Transaction "G547 - Return OCO to Owner" included 21 activities or 1.0% of the total activities.

- Transaction "G548 - Send OCO to GC Accounting" included 1 activity or 0.1% of the total activities.

- Transaction "G549 - Archive OCO in GC's OCO Folder" includes 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- The main exceptions would be transactions "G546" and "G549" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-i).
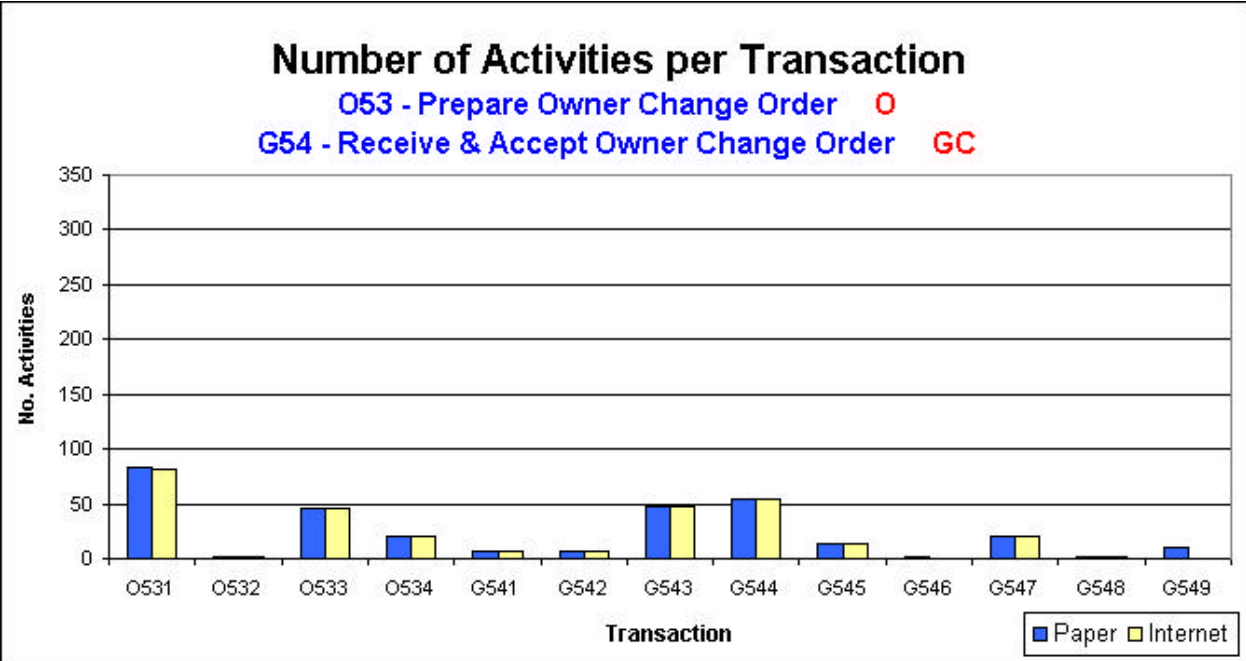
Figure C-2-i. *Comparison of activities per transaction to prepare & accept the Owner Change Order with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
O531 - Prepare Owner Change Order (OCO)	83	3.8%	82	4.2%
O532 - Review & Approve OCO	2	0.1%	2	0.1%
O533 - Log OCO in O's OCOR Log	46	2.1%	46	2.4%
O534 - Send OCO to GC	21	1.0%	21	1.1%
G541 - Receive OCO	6	0.3%	6	0.3%
G542 - GC Accept OCO	6	0.3%	6	0.3%
G543 - Log OCO in GC's OCOR Log	48	2.2%	48	2.5%
G544 - Log OCO in O-GC-S CO Log	54	2.5%	54	2.8%
G545 - Log OCO in GC's SCOR Log	14	0.6%	14	0.7%
G546 - Copy OCO	1	0.0%	0	0.0%
G547 - Return OCO to Owner	21	1.0%	21	1.1%
G548 - Send OCO to GC Accounting	1	0.0%	1	0.1%
G549 - Archive OCO in GC's OCO Folder	10	0.5%	0	0.0%
TOTAL Number of activities	313	14%	301	15%

Table C-2-m. *Distribution of activities per transaction for each type of system.*

C.1.2.2.10. Processing Effort per Transaction

How much effort would each transaction take to prepare & accept an Owner Change Order with the paper-based system vs. with an internet-based system?

O53 & G54 - Prepare & Accept Owner Change Order:
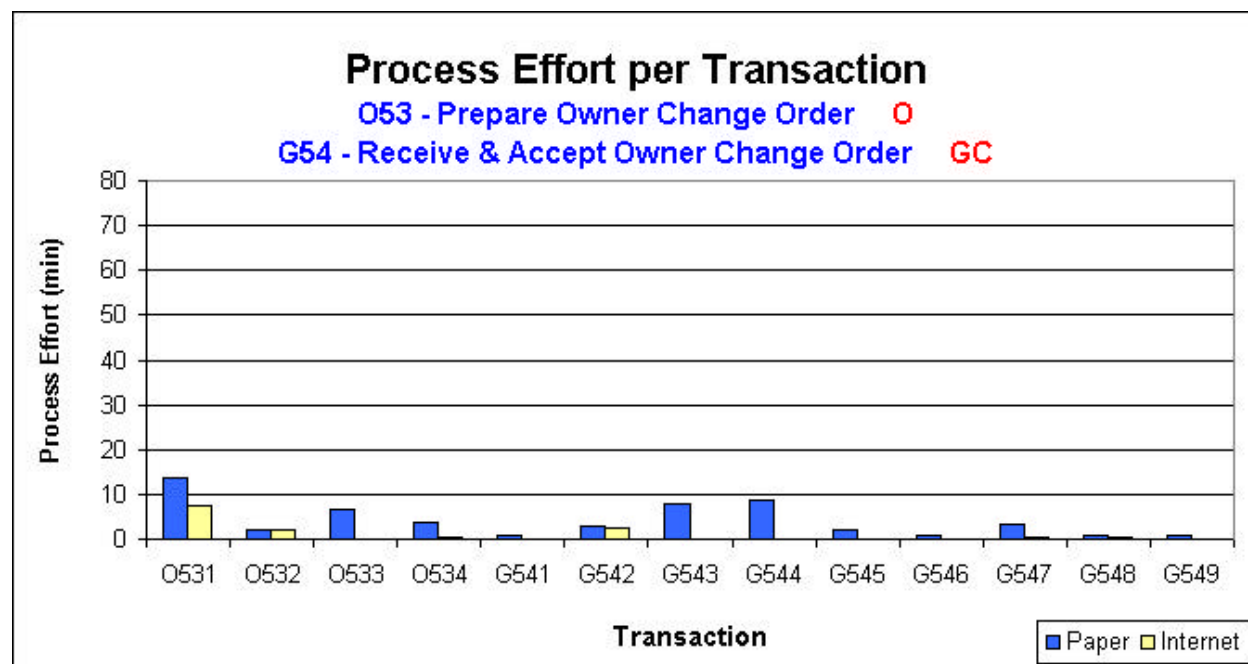
Paper-based process

- Transaction "O531 - Prepare OCO" took 14 minutes or 1.9% of the total processing effort.

- Transaction "O532 - Review & Approve OCO" took 2 minutes or 0.3% of the total processing effort.

- Transaction "O533 - Log OCO in O's OCOR Log" took 7 minutes or 1.0% of the total processing effort.

- Transaction "O534 - Send OCO to GC" took 4 minutes or 0.5% of the total processing effort.

- Transaction "G541 - Receive OCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "G542 - Accept OCO" took 3 minutes or 0.4% of the total processing effort.

- Transaction "G543 - Log OCO in GC's OCOR Log" took 8 minutes or 1.1% of the total processing effort.

- Transaction "G544 - Log OCO in O-GC-S CO Log" took 9 minutes or 1.2% of the total processing effort.

- Transaction "G545 - Log OCO in GC's SCOR Log" took 2 minutes or 0.3% of the total processing effort.

- Transaction "G546 - Copy OCO" took 3 minutes or 0.4% of the total processing effort.

- Transaction "G547 - Return OCO to Owner" took 1 minute or 0.1% of the total processing effort.

- Transaction "G548 - Send OCO to GC Accounting" took 1 minute or 0.1% of the total processing effort.

- Transaction "G549 - Archive OCO in GC's OCO Folder" would take 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "O531 - Prepare OCO" would take 7 minutes or 3.9% of the total processing effort. This would be a reduction of 46% in processing effort.

- Transaction "O532 - Accept OCO" would still take 2 minutes or 1.2% of the total effort. There would be no reduction in processing effort.

- The rest of the activities would mostly be automated and only "G546" and "G549" would be eliminated. (Figure C-2-j).

Figure C-2-j. *Comparison of processing effort per transaction to prepare & process the Owner Change Order with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

Transaction	Paper	% of Effort	Internet	% of Effort
O531 - Prepare Owner Change Order (OCO)	14	1.9%	7	3.9%
O532 - Review & Approve OCO	2	0.3%	2	1.2%
O533 - Log OCO in O's OCOR Log	7	1.0%	0	0.0%
O534 - Send OCO to GC	4	0.5%	0	0.1%
G541 - Receive OCO	1	0.1%	0	0.0%
G542 - GC Accept OCO	3	0.4%	3	1.4%
G543 - Log OCO in GC's OCOR Log	8	1.1%	0	0.0%
G544 - Log OCO in O-GC-S CO Log	9	1.2%	0	0.0%
G545 - Log OCO in GC's SCOR Log	2	0.3%	0	0.0%
G546 - Copy OCO	1	0.1%	0	0.0%
G547 - Return OCO to Owner	3	0.4%	0	0.1%
G548 - Send OCO to GC Accounting	1	0.1%	0	0.1%
G549 - Archive OCO in GC's OCO Folder	1	0.1%	0	0.0%
TOTAL Processing Effort	55	8%	13	7%

Table C-2-n. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
O531 - Prepare Owner Change Order (OCO)	14	7	-46%
O532 - Review & Approve OCO	2	2	0%
O533 - Log OCO in O's OCOR Log	7	0	-100%
O534 - Send OCO to GC	4	0	-93%
G541 - Receive OCO	1	0	-100%
G542 - GC Accept OCO	3	3	-9%
G543 - Log OCO in GC's OCOR Log	8	0	-100%
G544 - Log OCO in O-GC-S CO Log	9	0	-100%
G545 - Log OCO in GC's SCOR Log	2	0	-100%
G546 - Copy OCO	3	0	-100%
G547 - Return OCO to Owner	1	0	-92%
G548 - Send OCO to GC Accounting	1	0	-75%
G549 - Archive OCO in GC's OCO Folder	1	0	-100%
TOTAL Processing Effort	55	13	-76%

Table C-2-o. *Percentage decrease in processing effort per transaction due to an internet-based system.*

O54, O55 &G55 - Execute & Post Owner Change Order:

C.1.2.2.11. Number of Activities per Transaction

How many activities are included in each transaction to execute & post the Owner Change Order with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "O541 - Receive Owner Change Order (OCO) - accepted" included 6 activities or 0.3% of the total activities.

- Transaction "O542 - Execute OCO" included 4 activities or 0.2% of the total activities.

- Transaction "O543 - Update O's OCOR Log" included 9 activities or 0.4% of the total activities.

- Transaction "O544 - Copy OCO" included 1 activity or 0.1% of the total activities.

- Transaction "O545 - Send OCO to O Accounting" included 1 activity or 0.1% of the total activities.

- Transaction "O546 - Archive OCO in O's OCO Folder" included 10 activities or 0.5% of the total activities.

- Transaction "O551 - Receive OCO" included 1 activity or 0.1% of the total activities.

- Transaction "O552 - Post OCO in O's Accounting DB" included 38 activities or 1.7% of the total activities.

- Transaction "O553 - Archive OCO in O's OCO Folder" included 10 activities or 0.5% of the total activities.

- Transaction "G551 - Receive OCO" included 1 activity or 0.1% of the total activities.

- Transaction "G552- Post OCO in GC's Accounting DB for Billing" included 47 activities or 2.1% of the total activities.

- Transaction "G553 - Archive OCO in GC's OCO Folder" included 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- The main exceptions would be transactions "O544", "O546", "O553" and "G553" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-k).
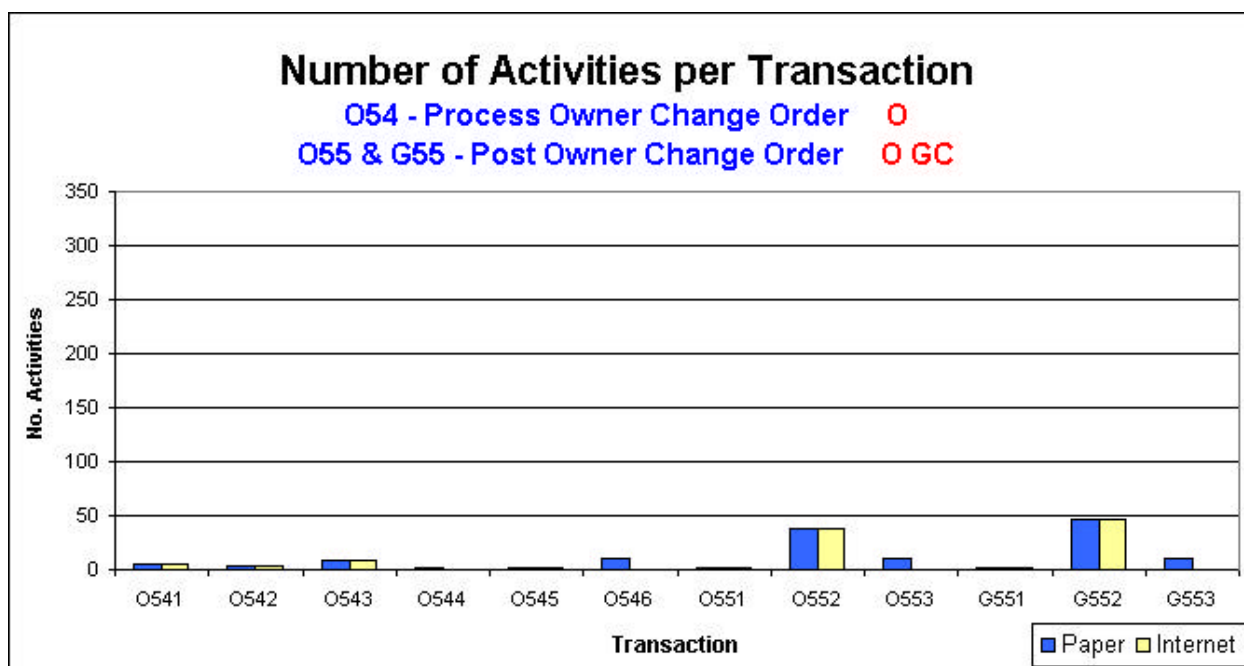
Figure C-2-k. *Comparison of activities per transaction to execute & post an Owner Change Order with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
O541 - Receive Owner Change Order (OCO)	6	0.3%	6	0.3%
O542 - Execute OCO	4	0.2%	4	0.2%
O543 - Update O's OCOR Log	9	0.4%	9	0.5%
O544 - Copy OCO	1	0.0%	0	0.0%
O545 - Send OCO to O Accounting	1	0.0%	1	0.1%
O546 - Archive OCO in O's OCO Folder	10	0.5%	0	0.0%
O551 - Receive OCO	1	0.0%	1	0.1%
O552 - Post OCO in Accounting DB	38	1.7%	38	1.9%
O553 - Archive OCO in O's OCO Folder	10	0.5%	0	0.0%
G551 - Receive OCO	1	0.0%	1	0.1%
G552 - Post OCO in GC's Accounting DB	47	2.1%	47	2.4%
G553 - Archive OCO in GC's OCO Folder	10	0.5%	0	0.0%
TOTAL Number of activities	**138**	**6%**	**107**	**5%**

Table C-2-p. *Distribution of activities per transaction for each type of system.*

C.1.2.2.12. Processing Effort per Transaction

How much effort would each transaction take to execute & post an Owner Change Order with the paper-based system vs. with an internet-based system?

O54, O55 &G55 - Execute & Post Owner Change Order:

Paper-based process

- Transaction "O541 - Receive Owner Change Order (OCO) - accepted" took 14 minutes or 1.9% of the total processing effort..

- Transaction "O542 - Execute OCO" took 2 minutes or 0.3% of the total processing effort.

- Transaction "O543 - Update O's OCOR Log" took 7 minutes or 1.0% of the total processing effort.

- Transaction "O544 - Copy OCO" took 4 minutes or 0.5% of the total processing effort.

- Transaction "O545 - Send OCO to O Accounting" took 1 minute or 0.1% of the total processing effort.

- Transaction "O546 - Archive OCO in O's OCO Folder" took 3 minutes or 0.4% of the total processing effort.

- Transaction "O551 - Receive OCO" took 8 minutes or 1.1% of the total processing effort.

- Transaction "O552 - Post OCO in O's Accounting DB" took 9 minutes or 1.2% of the total processing effort.

- Transaction "O553 - Archive OCO in O's OCO Folder" took 2 minutes or 0.3% of the total processing effort.

- Transaction "G551 - Receive OCO" took 3 minutes or 0.4% of the total processing effort.

- Transaction "G552- Post OCO in GC's Accounting DB for Billing" took 1 minute or 0.1% of the total processing effort.

- Transaction "G553 - Archive OCO in GC's OCO Folder" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "O542 - Execute OCO" would take 1.3 minutes or 0.7% of the total processing effort. This would be a reduction of 6% in processing effort.

- Transaction "O545 - Send OCO to O Accounting" would take 0.3 minutes or 0.1% of the total effort. This would be a reduction of 75% in processing effort.

- The rest of the activities would mostly be automated and only "O544", "O546", "O553" and "G553" would be eliminated. (Figure C-2-l).
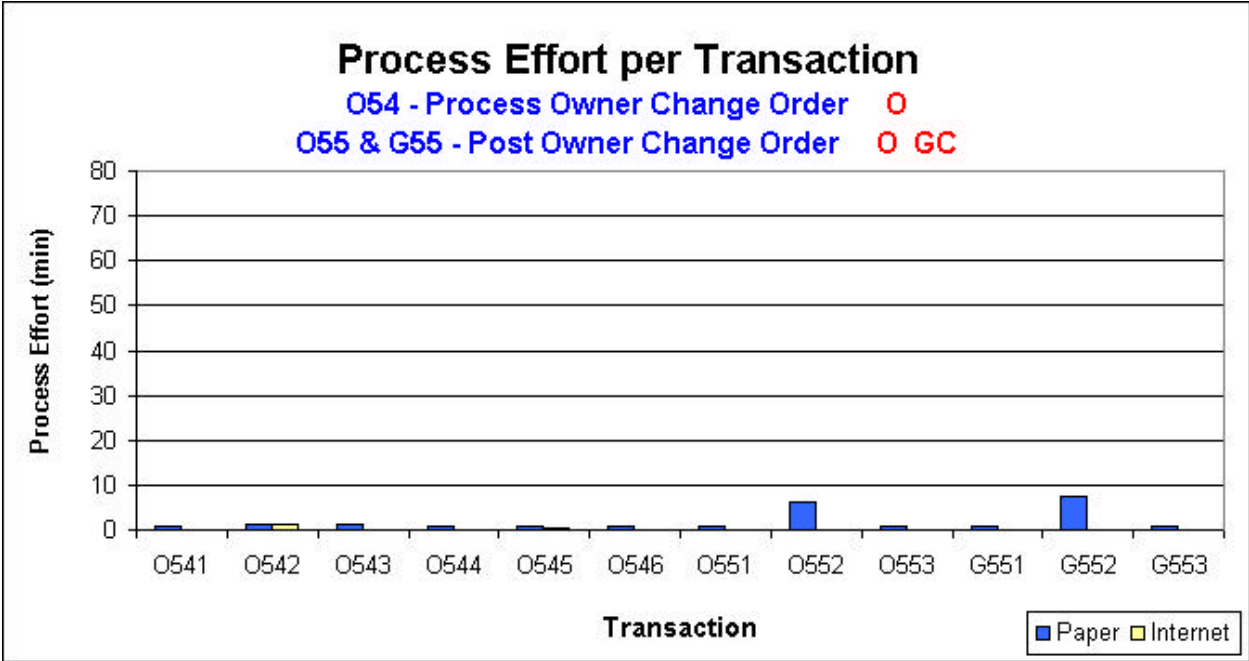

Figure C-2-l. *Comparison of processing effort per transaction to execute & post the Owner Change Order with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

Transaction	Paper	% of Effort	Internet	% of Effort
O541 - Receive Owner Change Order (OCO)	0.8	0.1%	0.0	0.0%
O542 - Execute OCO	1.4	0.2%	1.3	0.7%
O543 - Update O's OCOR Log	1.4	0.2%	0.0	0.0%
O544 - Copy OCO	1.0	0.1%	0.0	0.0%
O545 - Send OCO to O Accounting	1.0	0.1%	0.3	0.1%
O546 - Archive OCO in O's OCO Folder	1.0	0.1%	0.0	0.0%
O551 - Receive OCO	1.0	0.1%	0.0	0.0%
O552 - Post OCO in Accounting DB	6.3	0.9%	0.0	0.0%
O553 - Archive OCO in O's OCO Folder	1.0	0.1%	0.0	0.0%
G551 - Receive OCO	1.0	0.1%	0.0	0.0%
G552 - Post OCO in GC's Accounting DB	7.4	1.0%	0.0	0.0%
G553 - Archive OCO in GC's OCO Folder	1.0	0.1%	0.0	0.0%
TOTAL Processing Effort	24	3%	1.6	1%

Table C-2-q. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
O541 - Receive Owner Change Order (OCO)	0.8	0.0	-100%
O542 - Execute OCO	1.4	1.3	-6%
O543 - Update O's OCOR Log	1.4	0.0	-100%
O544 - Copy OCO	1.0	0.0	-100%
O545 - Send OCO to O Accounting	1.0	0.3	-75%
O546 - Archive OCO in O's OCO Folder	1.0	0.0	-100%
O551 - Receive OCO	1.0	0.0	-100%
O552 - Post OCO in Accounting DB	6.3	0.0	-100%
O553 - Archive OCO in O's OCO Folder	1.0	0.0	-100%
G551 - Receive OCO	1.0	0.0	-100%
G552 - Post OCO in GC's Accounting DB	7.4	0.0	-100%
G553 - Archive OCO in GC's OCO Folder	1.0	0.0	-100%
TOTAL Processing Effort	24	1.6	-93%

Table C-2-r. *Percentage decrease in processing effort per transaction due to an internet-based system.*

G56 & S53 - Prepare & Accept Sub Change Order (MSD Sub):

C.1.2.2.13. Number of Activities per Transaction

How many activities are included in each transaction to prepare and accept the MSD Sub Change Order with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "G561 - Prepare Sub Change Order (SCO) - MSD Sub" included 99 activities or 4.5% of the total activities.

- Transaction "G562 - Review & Approve SCO (before sending to MSD)" included 2 activities or 0.1% of the total activities.

- Transaction "G563 - Log SCO in GC's SCOR Log" included 30 activities or 1.4% of the total activities.

- Transaction "G564 - Send SCO to MSD" included 20 activities or 0.9% of the total activities.

- Transaction "S531 - Receive SCO" included 6 activities or 0.3% of the total activities.

- Transaction "S532 - MSD Accept SCO" included 6 activities or 0.3% of the total activities.

- Transaction "S533- Log SCO in GC's SCOR Log" included 13 activities or 0.6% of the total activities.

- Transaction "S534 - Copy SCO" included 1 activity or 0.1% of the total activities.

- Transaction "S535 - Return SCO to GC" included 21 activities or 1.0% of the total activities.

- Transaction "S536 - Send SCO to MSD Accounting" included 1 activity or 0.1% of the total activities.

- Transaction "S537 - Archive SCO in MSD's SCO Folder" included 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- The main exceptions would be transactions "S534" and "S537" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-m).
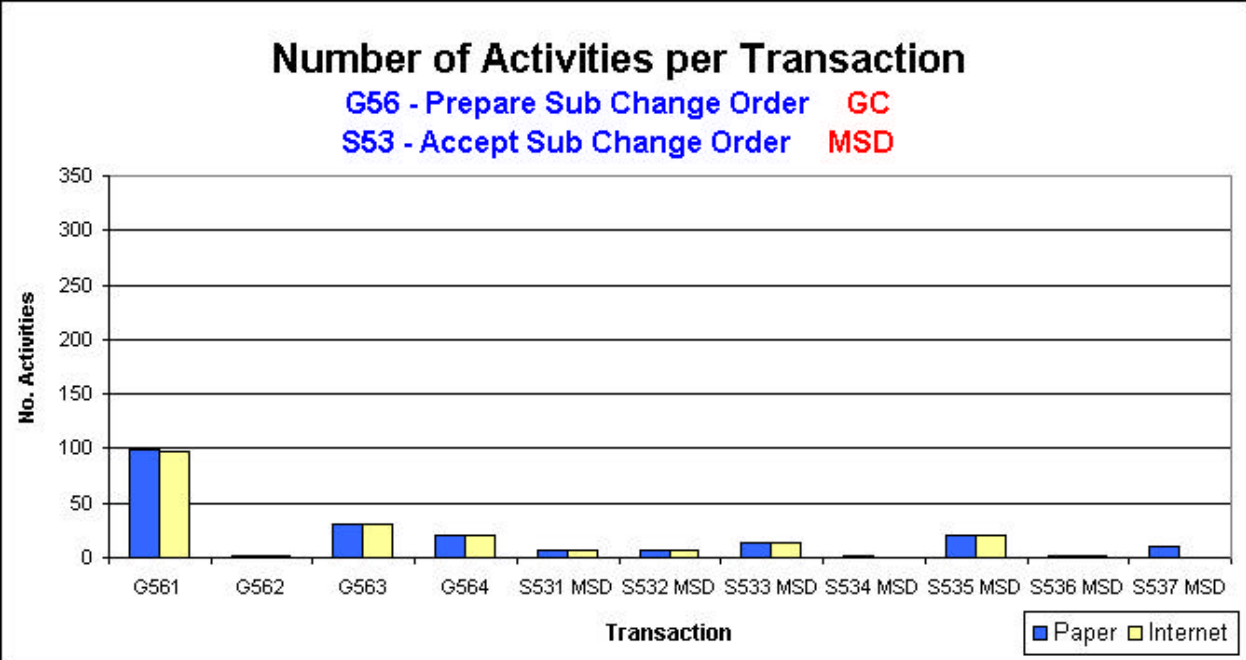

Figure C-2-m. *Comparison of activities per transaction to prepare & accept the MSD Sub Change Order with the paper-based system vs. an internet-based system.*

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Transaction	Paper	% of Activities	Internet	% of Activities
G561 - Prepare MSD Sub Change Order (SCO)	99	4.5%	98	5.0%
G562 - Review & Approve SCO	2	0.1%	2	0.1%
G563 - Log SCO in GC's SCOR Log	30	1.4%	30	1.5%
G564 - Send SCO to MSD Sub	20	0.9%	20	1.0%
S531 - Receive SCO	6	0.3%	6	0.3%
S532 - MSD Accept SCO	6	0.3%	6	0.3%
S533 - Log SCO in MSD's SCOR Log	13	0.6%	13	0.7%
S534 - Copy SCO	1	0.0%	0	0.0%
S535 - Return SCO to GC	21	1.0%	21	1.1%
S536 - Send SCO to MSD Accounting	1	0.0%	1	0.1%
S537 - Archive SCO in MSD's SCO Folder	10	0.5%	0	0.0%
TOTAL Number of activities	209	10%	197	10%

Table C-2-s. *Distribution of activities per transaction for each type of system.*

C.1.2.2.14. Processing Effort per Transaction

How much effort would each transaction take to prepare & accept the MSD Sub Change Order with the paper-based system vs. with an internet-based system?

G56 & S53 - Prepare & Accept Sub Change Order (MSD Sub):

Paper-based process

- Transaction "G561 - Prepare SCO" took 12 minutes or 1.7% of the total processing effort.

- Transaction "G562 - Review & Approve SCO" took 2 minutes or 0.3% of the total processing effort.

- Transaction "G563 - Log SCO in GC's SCOR Log" took 5 minutes or 0.7% of the total processing effort.

- Transaction "G564 - Send SCO to MSD" took 3 minutes or 0.5% of the total processing effort.

- Transaction "S531 - Receive SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "S532 - Accept SCO" took 3 minutes or 0.4% of the total processing effort.

- Transaction "S533 - Log SCO in MSD's SCOR Log" took 2 minutes or 0.3% of the total processing effort.

- Transaction "S534 - Copy SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "S535 - Return SCO to GC" took 3 minute or 0.4% of the total processing effort.

- Transaction "S536 - Send SCO to MSD Accounting" took 1 minute or 0.1% of the total processing effort.

- Transaction "S537 - Archive SCO in MSD's SCO Folder" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "G561 - Prepare SCO" would take 5 minutes or 2.9% of the total processing effort. This would be a reduction of 55% in processing effort.

- Transaction "S532 - Accept SCO" would still take 3 minutes or 1.4% of the total effort. This would be a reduction of 9% in processing effort.

- The rest of the activities would be automated and only "S534" and "S537" would be eliminated. (Figure C-2-n).
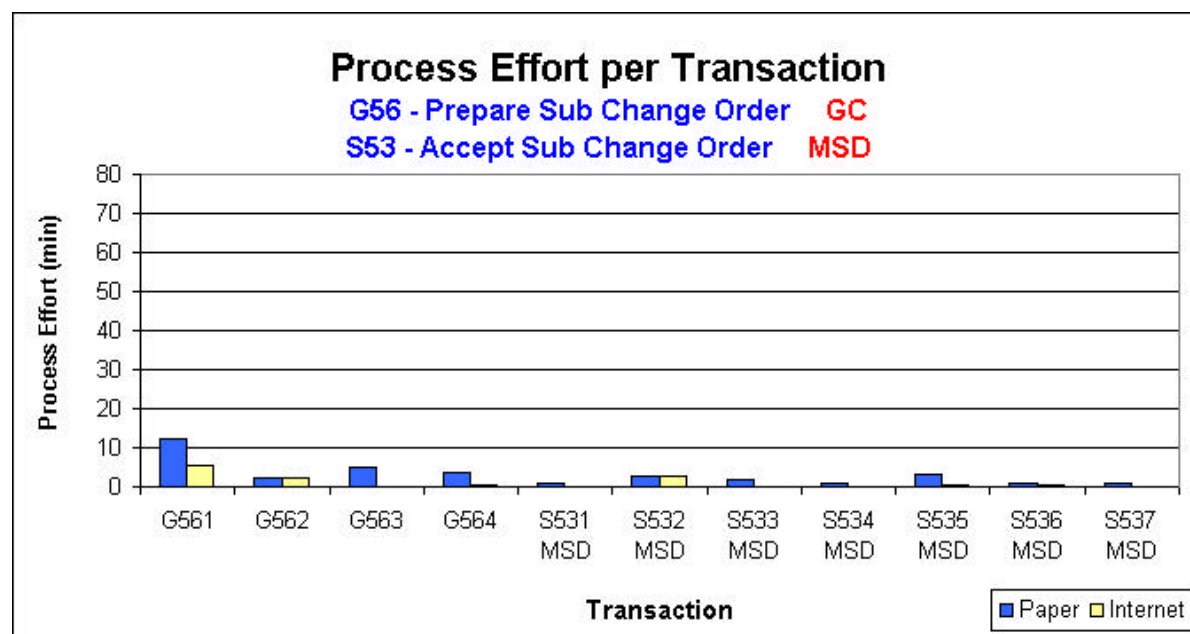
Figure C-2-n. *Comparison of processing effort per transaction to prepare & accept the MSD Sub Change Order with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Effort	Internet	% of Effort
G561 - Prepare MSD Sub Change Order (SCO)	12	1.7%	5	2.9%
G562 - Review & Approve SCO	2	0.3%	2	1.2%
G563 - Log SCO in GC's SCOR Log	5	0.7%	0	0.0%
G564 - Send SCO to MSD Sub	3	0.5%	0	0.1%
S531 - Receive SCO	1	0.1%	0	0.0%
S532 - MSD Accept SCO	3	0.4%	3	1.4%
S533 - Log SCO in MSD's SCOR Log	2	0.3%	0	0.0%
S534 - Copy SCO	1	0.1%	0	0.0%
S535 - Return SCO to GC	3	0.4%	0	0.1%
S536 - Send SCO to MSD Accounting	1	0.1%	0	0.1%
S537 - Archive SCO in MSD's SCO Folder	1	0.1%	0	0.0%
TOTAL Processing Effort	34	5%	11	6%

Table C-2-t. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
G561 - Prepare MSD Sub Change Order (SCO)	12	5	-55%
G562 - Review & Approve SCO	2	2	0%
G563 - Log SCO in GC's SCOR Log	5	0	-100%
G564 - Send SCO to MSD Sub	3	0	-93%
S531 - Receive SCO	1	0	-100%
S532 - MSD Accept SCO	3	3	-9%
S533 - Log SCO in MSD's SCOR Log	2	0	-100%
S534 - Copy SCO	1	0	-100%
S535 - Return SCO to GC	3	0	-92%
S536 - Send SCO to MSD Accounting	1	0	-75%
S537 - Archive SCO in MSD's SCO Folder	1	0	-100%
TOTAL Processing Effort	34	11	-68%

Table C-2-u. *Percentage decrease in processing effort per transaction due to an internet-based system.*

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G56 & S53 - Prepare & Accept Sub Change Order (WI Sub):

C.1.2.2.15. Number of Activities per Transaction

   How many activities are included in each transaction to prepare and accept the WI Sub Change Order with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "G561 - Prepare Sub Change Order (SCO) - WI Sub" included 67 activities or 3.1% of the total activities.

- Transaction "G562 - Review & Approve SCO (before sending to WI)" included 2 activities or 0.1% of the total activities.

- Transaction "G563 - Log SCO in GC's SCOR Log" included 18 activities or 0.8% of the total activities.

- Transaction "G564 - Send SCO to WI" included 6 activities or 0.3% of the total activities.

- Transaction "S531 - Receive SCO" included 6 activities or 0.3% of the total activities.

- Transaction "S532 - WI Accept SCO" included 6 activities or 0.3% of the total activities.

- Transaction "S533- Log SCO in GC's SCOR Log" included 13 activities or 0.6% of the total activities.

- Transaction "S534 - Copy SCO" included 1 activity or 0.1% of the total activities.

- Transaction "S535 - Return SCO to GC" included 21 activities or 1.0% of the total activities.

- Transaction "S536 - Send SCO to WI Accounting" included 1 activity or 0.1% of the total activities.

- Transaction "S537 - Archive SCO in WI's SCO Folder" included 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- The main exceptions would be transactions "S534" and "S537" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-o).
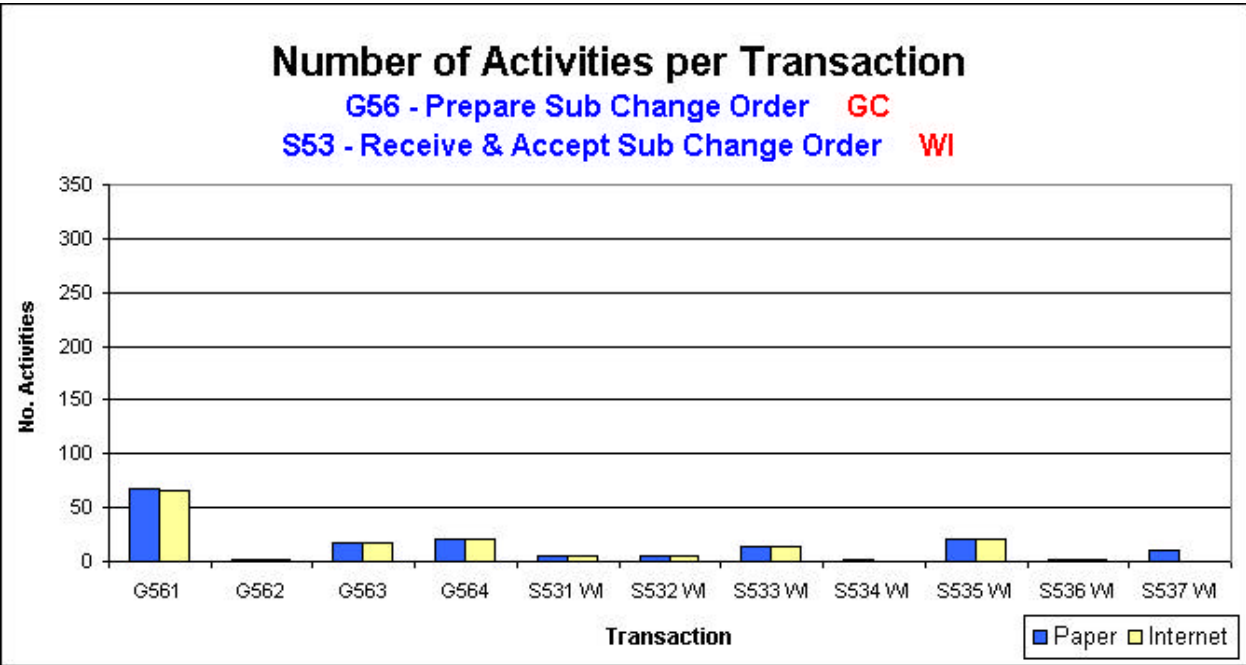

Figure C-2-o. *Comparison of activities per transaction to prepare & accept the WI Sub Change Order with a paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
G561 - Prepare WI Sub Change Order (SCO)	67	3.1%	66	3.4%
G562 - Review & Approve SCO	2	0.1%	2	0.1%
G563 - Log SCO in GC's SCOR Log	18	0.8%	18	0.9%
G564 - Send SCO to WI Sub	20	0.9%	20	1.0%
S531 - Receive SCO	6	0.3%	6	0.3%
S532 - WI Accept SCO	6	0.3%	6	0.3%
S533 - Log SCO in WI's SCOR Log	13	0.6%	13	0.7%
S534 - Copy SCO	1	0.0%	0	0.0%
S535 - Return SCO to GC	21	1.0%	20	1.0%
S536 - Send SCO to WI Accounting	1	0.0%	1	0.1%
S537 - Archive SCO in WI's SCO Folder	10	0.5%	0	0.0%
TOTAL Number of activities	**165**	**8%**	**152**	**8%**

Table C-2-v. *Distribution of activities per transaction for each type of system.*

C.1.2.2.16. Processing Effort per Transaction

How much effort would each transaction take to prepare & accept the WI Sub Change Order with the paper-based system vs. with an internet-based system?

G56 & S53 - Prepare & Accept Sub Change Order (WI Sub):

Paper-based process

- Transaction "G561 - Prepare SCO" took 8 minutes or 1.1% of the total processing effort.

- Transaction "G562 - Review & Approve SCO" took 2 minutes or 0.3% of the total processing effort.

- Transaction "G563 - Log SCO in GC's SCOR Log" took 3 minutes or 0.4% of the total processing effort.

- Transaction "G564 - Send SCO to WI" took 3 minutes or 0.5% of the total processing effort.

- Transaction "S531 - Receive SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "S532 - Accept SCO" took 3 minutes or 0.4% of the total processing effort.

- Transaction "S533 - Log SCO in WI's SCOR Log" took 2 minutes or 0.3% of the total processing effort.

- Transaction "S534 - Copy SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "S535 - Return SCO to GC" took 3 minute or 0.4% of the total processing effort.

- Transaction "S536 - Send SCO to WI Accounting" took 1 minute or 0.1% of the total processing effort.

- Transaction "S537 - Archive SCO in WI's SCO Folder" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "G561 - Prepare SCO" would take 3 minutes or 1.7% of the total processing effort. This would be a reduction of 59% in processing effort.

- Transaction "S532 - Accept SCO" would still take 3 minutes or 1.4% of the total effort. This would be a reduction of 9% in processing effort.

- The rest of the activities would be automated and only "S534" and "S537" would be eliminated. (Figure C-2-p).
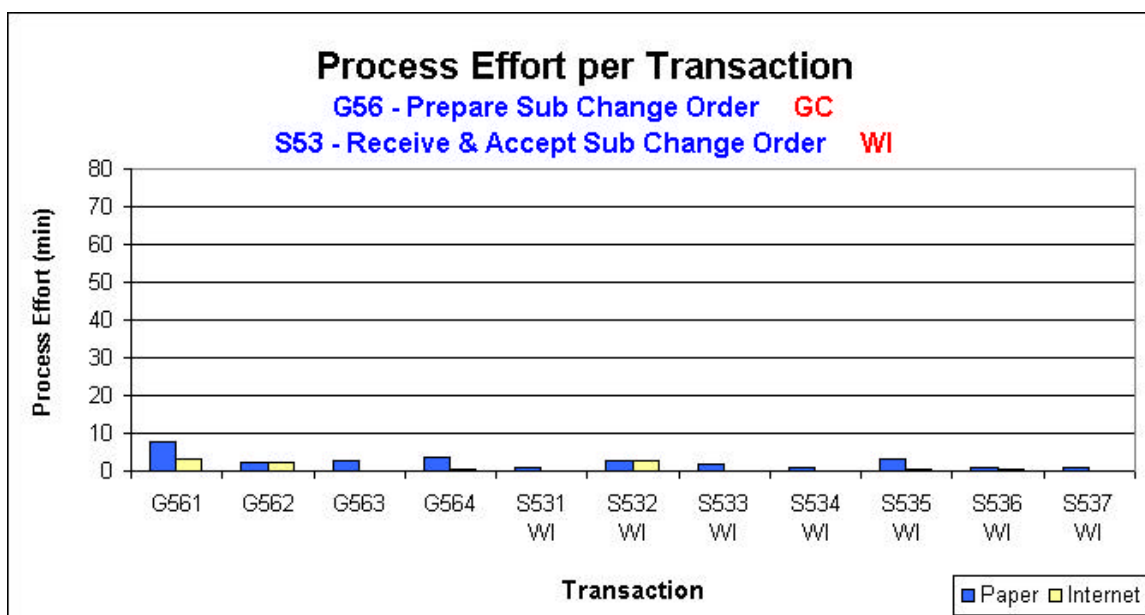
Figure C-2-p. *Comparison of processing effort per transaction to prepare & accept the WI Sub Change Order with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Effort	Internet	% of Effort
G561 - Prepare WI Sub Change Order (SCO)	8	1.1%	3	1.7%
G562 - Review & Approve SCO	2	0.3%	2	1.2%
G563 - Log SCO in GC's SCOR Log	3	0.4%	0	0.0%
G564 - Send SCO to WI Sub	3	0.5%	0	0.1%
S531 - Receive SCO	1	0.1%	0	0.0%
S532 - WI Accept SCO	3	0.4%	3	1.4%
S533 - Log SCO in WI's SCOR Log	2	0.3%	0	0.0%
S534 - Copy SCO	1	0.1%	0	0.0%
S535 - Return SCO to GC	3	0.4%	0	0.1%
S536 - Send SCO to WI Accounting	1	0.1%	0	0.1%
S537 - Archive SCO in WI's SCO Folder	1	0.1%	0	0.0%
TOTAL Processing Effort	**28**	**4%**	**9**	**5%**

Table C-2-w. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
G561 - Prepare WI Sub Change Order (SCO)	8	3	-59%
G562 - Review & Approve SCO	2	2	0%
G563 - Log SCO in GC's SCOR Log	3	0	-100%
G564 - Send SCO to WI Sub	3	0	-93%
S531 - Receive SCO	1	0	-100%
S532 - WI Accept SCO	3	3	-9%
S533 - Log SCO in WI's SCOR Log	2	0	-100%
S534 - Copy SCO	1	0	-100%
S535 - Return SCO to GC	3	0	-92%
S536 - Send SCO to WI Accounting	1	0	-75%
S537 - Archive SCO in WI's SCO Folder	1	0	-100%
TOTAL Processing Effort	**28**	**9**	**-69%**

Table C-2-x. *Percentage decrease in processing effort per transaction due to an internet-based system.*

G57, G58 &S54 - Execute & Post Sub Change Order (MSD Sub):

C.1.2.2.17. Number of Activities per Transaction

How many activities are included in each transaction to execute and post the MSD Sub Change Order with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "G571 - Receive Sub Change Order (SCO) - accepted" included 6 activities or 0.3% of the total activities.

- Transaction "G572 - Execute SCO" included 4 activities or 0.2% of the total activities.

- Transaction "G573 - Update GC's SCOR Log" included 9 activities or 0.4% of the total activities.

- Transaction "G574 - Update O-GC-S CO Log" included 9 activities or 0.4% of the total activities.

- Transaction "G575 - Copy SCO" included 1 activity or 0.1% of the total activities.

- Transaction "G576 - Send SCO to GC Accounting" included 1 activity or 0.1% of the total activities.

- Transaction "G577 - Archive SCO in GC's SCO Folder" included 10 activities or 0.5% of the total activities.

- Transaction "G581 - GC Accounting Receive SCO" included 1 activity or 0.1% of the total activities.

- Transaction "G582 - Post SCO in GC's Accounting DB" included 12 activities or 0.5% of the total activities.

- Transaction "G583 - Archive SCO in GC's SCO Folder" included 10 activities or 0.5% of the total activities.

- Transaction "S541 - MSD Receive SCO" included 6 activities or 0.3% of the total activities.

- Transaction "S542- Post SCO in MSD's Accounting DB for Billing" included 11 activities or 0.5% of the total activities.

- Transaction "S543 - Archive SCO in MSD's SCO Folder" included 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- Te main exceptions would be transactions "G575", "G577", "G583" and "S543" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-q).
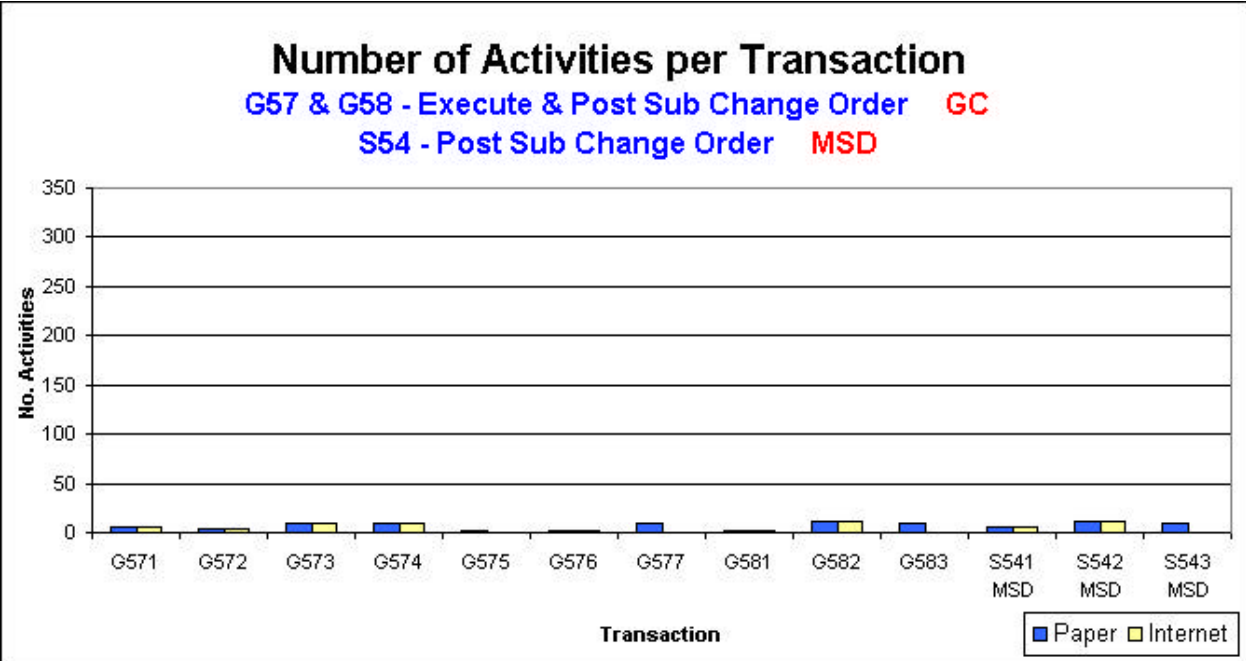
Figure C-2-q. *Comparison of activities per transaction to execute & post the MSD Sub Change Order with a paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
G571 - Receive Sub Change Order (SCO)	6	0.3%	6	0.3%
G572 - Execute SCO	4	0.2%	4	0.2%
G573 - Update GC's SCOR Log	9	0.4%	9	0.5%
G574 - Update O-GC-S CO Log	9	0.4%	9	0.5%
G575 - Copy SCO	1	0.0%	0	0.0%
G576 - Send SCO to MSD Accounting	1	0.0%	1	0.1%
G577 - Archive SCO in GC's SCO Folder	10	0.5%	0	0.0%
G581 - Receive SCO	1	0.0%	1	0.1%
G582 - Post SCO in Accounting DB	12	0.5%	12	0.6%
G583 - Archive SCO in GC's SCO Folder	10	0.5%	0	0.0%
S541 - Receive SCO	6	0.3%	6	0.3%
S542 - Post SCO in MSD's Accounting DB	11	0.5%	11	0.6%
S543 - Archive SCO in MSD's SCO Folder	10	0.5%	0	0.0%
TOTAL Number of activities	90	4%	59	3%

Table C-2-y. *Distribution of activities per transaction for each type of system.*

C.1.2.2.18. Processing Effort per Transaction

How much effort would each transaction take to execute & post a Sub Change Order with the paper-based system vs. with an internet-based system?

G57, G58 &S54 - Execute & Post Sub Change Order (MSD Sub):

Paper-based process

- Transaction "G571 - Receive Sub Change Order (SCO) - accepted" took 0.8 minutes or 0.1% of the total processing effort.

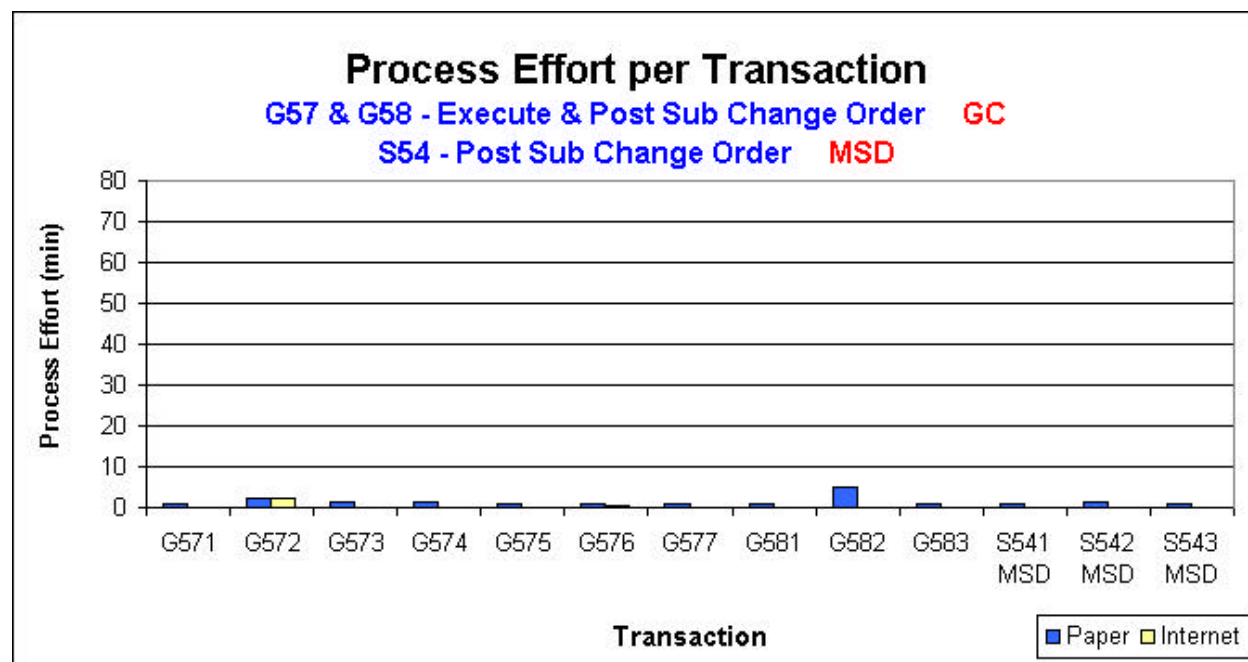- Transaction "G572 - Execute SCO" took 2.4 minutes or 0.3% of the total processing effort.

90

- Transaction "G573 - Update GC's SCOR Log" took 1.4 minutes or 0.2% of the total processing effort.

- Transaction "G574 - Update O-GC-S CO Log" took 1.2 minutes or 0.2% of the total processing effort.

- Transaction "G575 - Copy SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "G576 - Send SCO to GC Accounting" took 1 minute or 0.1% of the total processing effort.

- Transaction "G577 - Archive SCO in GC's SCO Folder" took 1 minute or 0.1% of the total processing effort.

- Transaction "G581 - GC Accounting Receive SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "G582 - Post SCO in GC's Accounting DB" took 4.9 minutes or 0.7% of the total processing effort.

- Transaction "G583 - Archive SCO in GC's SCO Folder" took 1 minute or 0.1% of the total processing effort.

- Transaction "S541 - Receive SCO" took 0.8 minutes or 0.1% of the total processing effort.

- Transaction "S542- Post SCO in MSD's Accounting DB for Billing" took 1.4 minutes or 0.2% of the total processing effort.

- Transaction "S543 - Archive SCO in MSD's SCO Folder" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "G572 - Execute SCO" would take 2.3 minutes or 1.3% of the total processing effort. This would be a reduction of 3% in processing effort.

- Transaction "G576 - Send SCO to GC Accounting" would take 0.3 minutes or 0.1% of the total effort. This would be a reduction of 75% in processing effort.

- The rest of the activities would mostly be automated and only "G575", "G577", "G583" and "S543" would be eliminated. (Figure C-2-r).

Figure C-2-r. *Comparison of processing effort per transaction to execute & post the MSD Sub Change Order with the paper-based system vs. an internet-based system.*

Transaction	Paper	% of Effort	Internet	% of Effort
G571 - Receive Sub Change Order (SCO)	0.8	0.1%	0.0	0.0%
G572 - Execute SCO	2.4	0.3%	2.3	1.3%
G573 - Update GC's SCOR Log	1.4	0.2%	0.0	0.0%
G574 - Update O-GC-S CO Log	1.2	0.2%	0.0	0.0%
G575 - Copy SCO	1.0	0.1%	0.0	0.0%
G576 - Send SCO to MSD Accounting	1.0	0.1%	0.3	0.1%
G577 - Archive SCO in GC's SCO Folder	1.0	0.1%	0.0	0.0%
G581 - Receive SCO	1.0	0.1%	0.0	0.0%
G582 - Post SCO in Accounting DB	4.9	0.7%	0.0	0.0%
G583 - Archive SCO in GC's SCO Folder	1.0	0.1%	0.0	0.0%
S541 - Receive SCO	0.8	0.1%	0.0	0.0%
S542 - Post SCO in MSD's Accounting DB	1.4	0.2%	0.0	0.0%
S543 - Archive SCO in MSD's SCO Folder	1.0	0.1%	0.0	0.0%
TOTAL Processing Effort	19	3%	3	1%

Table C-2-z. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
G571 - Receive Sub Change Order (SCO)	0.8	0.0	-100%
G572 - Execute SCO	2.4	2.3	-3%
G573 - Update GC's SCOR Log	1.4	0.0	-100%
G574 - Update O-GC-S CO Log	1.2	0.0	-100%
G575 - Copy SCO	1.0	0.0	-100%
G576 - Send SCO to MSD Accounting	1.0	0.3	-75%
G577 - Archive SCO in GC's SCO Folder	1.0	0.0	-100%
G581 - Receive SCO	1.0	0.0	-100%
G582 - Post SCO in Accounting DB	4.9	0.0	-100%
G583 - Archive SCO in GC's SCO Folder	1.0	0.0	-100%
S541 - Receive SCO	0.8	0.0	-100%
S542 - Post SCO in MSD's Accounting DB	1.4	0.0	-100%
S543 - Archive SCO in MSD's SCO Folder	1.0	0.0	-100%
TOTAL Processing Effort	19	3	-86%

Table C-2-aa. *Percentage decrease in processing effort per transaction due to an internet-based system.*

G57, G58 &S54 - Execute & Post Sub Change Order (WI Sub):

C.1.2.2.19. Number of Activities per Transaction

How many activities are included in each transaction to prepare and accept the WI Sub Change Order with the paper-based system vs. with an internet-based system?

Paper-based process

- Transaction "G571 - Receive Sub Change Order (SCO) - accepted" included 6 activities or 0.3% of the total activities.

- Transaction "G572 - Execute SCO" included 4 activities or 0.2% of the total activities.

- Transaction "G573 - Update GC's SCOR Log" included 8 activities or 0.4% of the total activities.

- Transaction "G574 - Update O-GC-S CO Log" included 9 activities or 0.4% of the total activities.

- Transaction "G575 - Copy SCO" included 1 activity or 0.1% of the total activities.

- Transaction "G576 - Send SCO to GC Accounting" included 1 activity or 0.1% of the total activities.

- Transaction "G577 - Archive SCO in GC's SCO Folder" included 10 activities or 0.5% of the total activities.

- Transaction "G581 - GC Accounting Receive SCO" included 1 activity or 0.1% of the total activities.

- Transaction "G582 - Post SCO in GC's Accounting DB" included 12 activities or 0.5% of the total activities.

- Transaction "G583 - Archive SCO in GC's SCO Folder" included 10 activities or 0.5% of the total activities.

- Transaction "S541 - MSD Receive SCO" included 6 activities or 0.3% of the total activities.

- Transaction "S542- Post SCO in MSD's Accounting DB for Billing" included 11 activities or 0.5% of the total activities.

- Transaction "S543 - Archive SCO in MSD's SCO Folder" included 10 activities or 0.5% of the total activities.

Internet-based process

- Most transactions would include the same number of activities as in the paper-based system.

- The main exceptions would be transactions "G575", "G577", "G583" and "S543" since the work to copy and archive change orders would be eliminated with an internet-based system (Figure C-2-s).
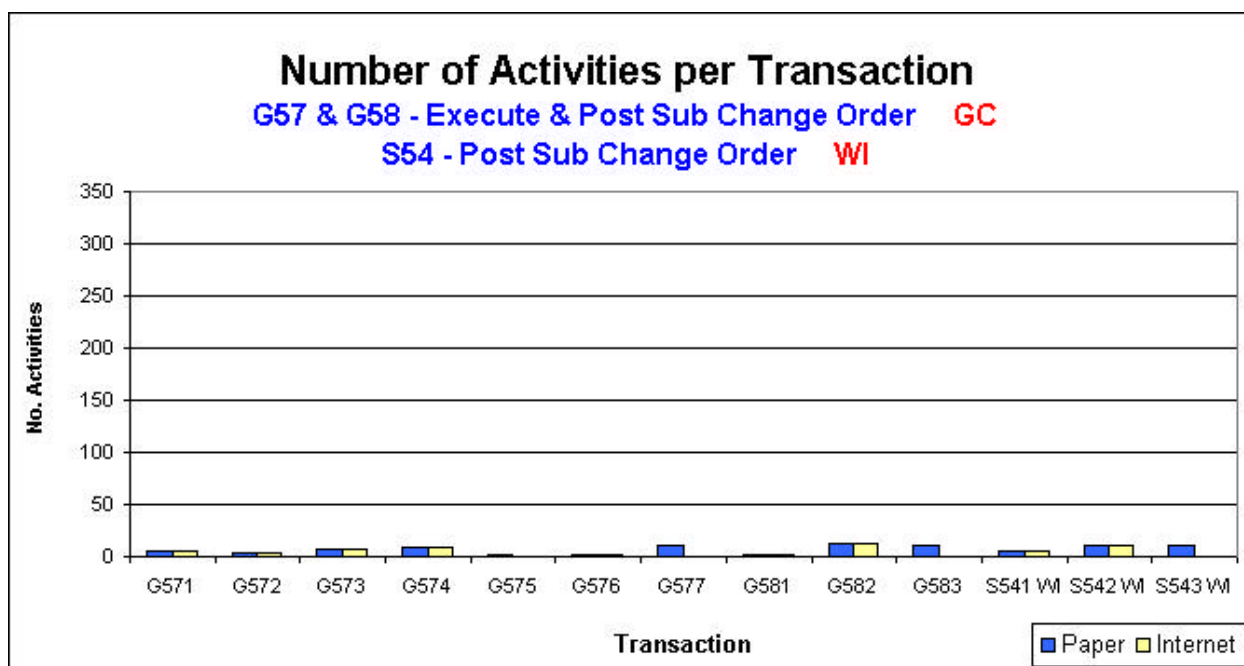
Figure C-2-s. *Comparison of activities per transaction to execute & post the WI Sub Change Order with a paper-based system vs. an internet-based system.*

Transaction	Paper	% of Activities	Internet	% of Activities
G571 - Receive Sub Change Order (SCO)	6	0.3%	6	0.3%
G572 - Execute SCO	4	0.2%	4	0.2%
G573 - Update GC's SCOR Log	8	0.4%	8	0.4%
G574 - Update O-GC-S CO Log	9	0.4%	9	0.5%
G575 - Copy SCO	1	0.0%	0	0.0%
G576 - Send SCO to WI Accounting	1	0.0%	1	0.1%
G577 - Archive SCO in GC's SCO Folder	10	0.5%	0	0.0%
G581 - Receive SCO	1	0.0%	1	0.1%
G582 - Post SCO in Accounting DB	12	0.5%	12	0.6%
G583 - Archive SCO in GC's SCO Folder	10	0.5%	0	0.0%
S541 - Receive SCO	6	0.3%	6	0.3%
S542 - Post SCO in WI's Accounting DB	11	0.5%	11	0.6%
S543 - Archive SCO in WI's SCO Folder	10	0.5%	0	0.0%
TOTAL Number of activities	89	4%	58	3%

Table C-2-ab. *Distribution of activities per transaction for each type of system.*

C.1.2.2.20. Processing Effort per Transaction

How much effort would each transaction take to execute & post the WI Sub Change Order with the paper-based system vs. with an internet-based system?

G57, G58 &S54 - Execute & Post Sub Change Order (WI Sub):

Paper-based process

- Transaction "G571 - Receive Sub Change Order (SCO) - accepted" took 0.8 minutes or 0.1% of the total processing effort.

- Transaction "G572 - Execute SCO" took 2.4 minutes or 0.3% of the total processing effort.

- Transaction "G573 - Update GC's SCOR Log" took 1.3 minutes or 0.2% of the total processing effort.

- Transaction "G574 - Update O-GC-S CO Log" took 1.2 minutes or 0.2% of the total processing effort.

- Transaction "G575 - Copy SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "G576 - Send SCO to GC Accounting" took 1 minute or 0.1% of the total processing effort.

- Transaction "G577 - Archive SCO in GC's SCO Folder" took 1 minute or 0.1% of the total processing effort.

- Transaction "G581 - GC Accounting Receive SCO" took 1 minute or 0.1% of the total processing effort.

- Transaction "G582 - Post SCO in GC's Accounting DB" took 2.9 minutes or 0.4% of the total processing effort.

- Transaction "G583 - Archive SCO in GC's SCO Folder" took 1 minute or 0.1% of the total processing effort.

- Transaction "S541 - Receive SCO" took 0.8 minutes or 0.1% of the total processing effort.

- Transaction "S542- Post SCO in WI's Accounting DB for Billing" took 1.4 minutes or 0.2% of the total processing effort.

- Transaction "S543 - Archive SCO in WI's SCO Folder" took 1 minute or 0.1% of the total processing effort.

Internet-based process

- Transaction "G572 - Execute SCO" would take 2.3 minutes or 1.3% of the total processing effort. This would be a reduction of 3% in processing effort.

- Transaction "G576 - Send SCO to GC Accounting" would take 0.3 minutes or 0.1% of the total effort. This would be a reduction of 75% in processing effort.

- The rest of the activities would mostly be automated and only "G575", "G577", "G583" and "S543" would be eliminated. (Figure C-2-t).
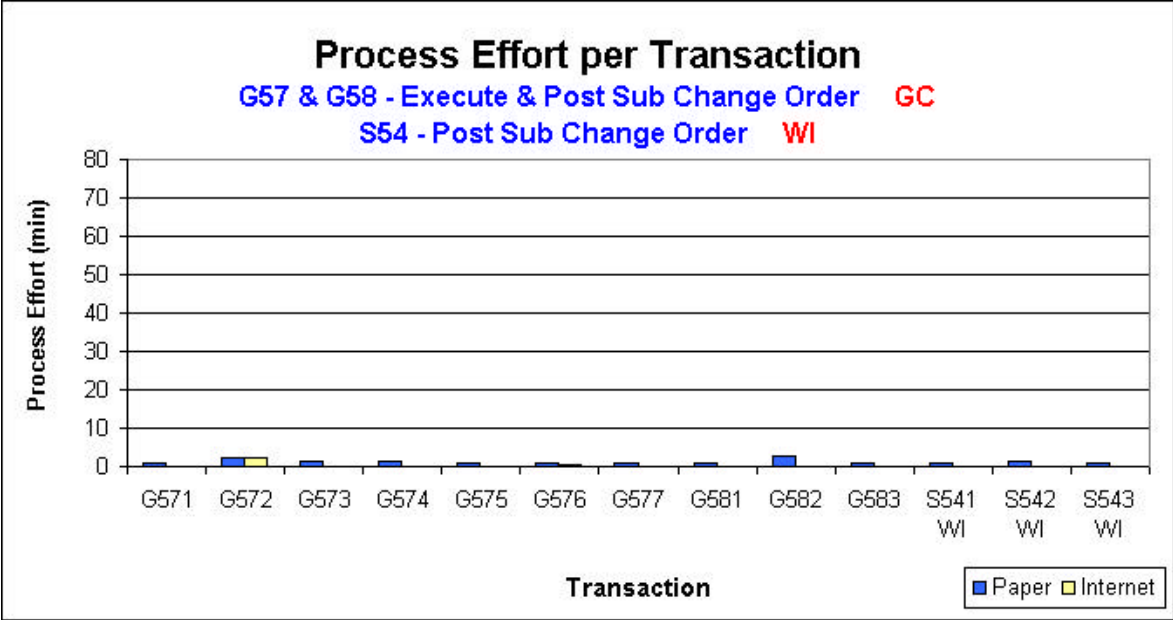

Figure C-2-t. *Comparison of processing effort per transaction to execute & post the WI Sub Change Order with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

Transaction	Paper	% of Effort	Internet	% of Effort
G571 - Receive Sub Change Order (SCO)	0.8	0.1%	0.0	0.0%
G572 - Execute SCO	2.4	0.3%	2.3	1.3%
G573 - Update GC's SCOR Log	1.3	0.2%	0.0	0.0%
G574 - Update O-GC-S CO Log	1.2	0.2%	0.0	0.0%
G575 - Copy SCO	1.0	0.1%	0.0	0.0%
G576 - Send SCO to WI Accounting	1.0	0.1%	0.3	0.1%
G577 - Archive SCO in GC's SCO Folder	1.0	0.1%	0.0	0.0%
G581 - Receive SCO	1.0	0.1%	0.0	0.0%
G582 - Post SCO in Accounting DB	2.9	0.4%	0.0	0.0%
G583 - Archive SCO in GC's SCO Folder	1.0	0.1%	0.0	0.0%
S541 - Receive SCO	0.8	0.1%	0.0	0.0%
S542 - Post SCO in WI's Accounting DB	1.4	0.2%	0.0	0.0%
S543 - Archive SCO in WI's SCO Folder	1.0	0.1%	0.0	0.0%
TOTAL Processing Effort	17	2%	3	1%

Table C-2-ac. *Distribution of processing effort per transaction for each type of system.*

Transaction	Paper (min)	Internet (min)	% Change
G571 - Receive Sub Change Order (SCO)	0.8	0.0	-100%
G572 - Execute SCO	2.4	2.3	-3%
G573 - Update GC's SCOR Log	1.3	0.0	-100%
G574 - Update O-GC-S CO Log	1.2	0.0	-100%
G575 - Copy SCO	1.0	0.0	-100%
G576 - Send SCO to WI Accounting	1.0	0.3	-75%
G577 - Archive SCO in GC's SCO Folder	1.0	0.0	-100%
G581 - Receive SCO	1.0	0.0	-100%
G582 - Post SCO in Accounting DB	2.9	0.0	-100%
G583 - Archive SCO in GC's SCO Folder	1.0	0.0	-100%
S541 - Receive SCO	0.8	0.0	-100%
S542 - Post SCO in WI's Accounting DB	1.4	0.0	-100%
S543 - Archive SCO in WI's SCO Folder	1.0	0.0	-100%
TOTAL Processing Effort	17	3	-85%

Table C-2-ad. *Percentage decrease in processing effort per transaction due to an internet-based system.*

C.1.3. Analysis Results per Organization

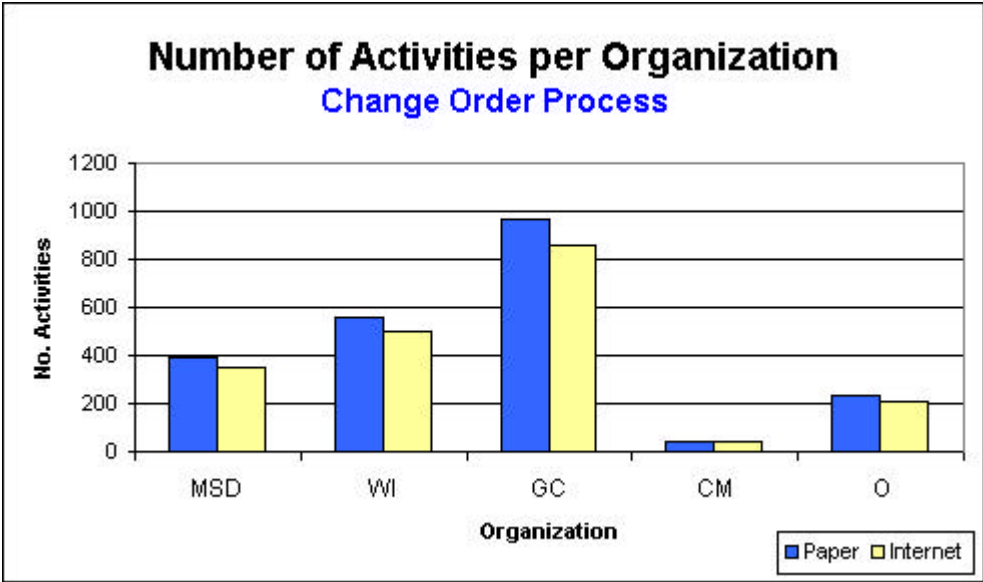C.1.3.1. Total Number of Activities per Organization

How many activities did the project organizations perform to process change orders with the paper-based system vs. with an internet-based system?

Paper-based process

- The Metal Stud & Drywall subcontractor (MSD) performed 389 activities or 18% of the total activities.
- The Wood Installer subcontractor (WI) performed 556 activities or 25% of the total activities.
- The General Contractor (GC) performed 970 activities or 44% of the total activities.
- The Construction Manager (CM) performed 41 activities or 2% of the total activities.
- The Owner (O) performed 232 activities or 11% of the total activities.

Internet-based process

- The MSD would perform 346 activities or 18% of the total activities.
- The WI would perform 500 activities or 26% of the total activities.
- The GC would perform 856 activities or 44% of the total activities.
- The CM would perform 41 activities or 2% of the total activities.
- The O would perform 210 activities or 11% of the total activities.

Figure C-3-a. *Comparison of number of activities per organization for the change order process with the paper-based system vs. an internet-based system.*

Organization	Paper	% of Activities	Internet	% of Activities
MSD	389	18%	346	18%
WI	556	25%	500	26%
GC	970	44%	856	44%
CM	41	2%	41	2%
O	232	11%	210	11%
TOTAL Number of activities	2188	100%	1953	100%

Table C-3-a. *Distribution of number of activities per organization for each type of system.*

C.1.3.2. Processing Effort per Organization

How much effort would the project organizations expend for the change order process with the paper-based system vs. with an internet-based system?

What decrease in each organization's effort would an internet-based system imply?

<u>Paper-based process</u>

- The Metal Stud & Drywall subcontractor (MSD) took 140 minutes or 20% of the total processing effort.

- The Wood Installer subcontractor (WI) took 176 minutes or 25% of the total processing effort.

- The General Contractor (GC) took 267 minutes or 38% of the total processing effort.

- The Construction Manager (CM) took 83 minutes or 12% of the total processing effort.

- The Owner (O) took 41 minute or 6% of the total processing effort.

<u>Internet-based process</u>

- The MSD sub would take 38 minutes or 20% of the total processing effort. The difference is 73% less effort than the paper-based system. He could be over 3 times more productive (Figure C-3-b).

- The WI sub would take 38 minutes or 20% of the total processing effort. The difference is 80% less effort than the paper-based system. He could be almost 4 times more productive.

- The GC would take 67 minutes or 36% of the total processing effort. The difference is 73% less effort than the paper-based system. He could be over 3 times more productive.

- The CM would take 32 minutes or 17% of the total processing effort. The difference is 61% less effort than the paper-based system. He could be over 2.5 times more productive.

- The Owner would take 11 minute or 6% of the total processing effort. The difference is 72% less effort than the paper-based system. He could be over 3 times more productive.
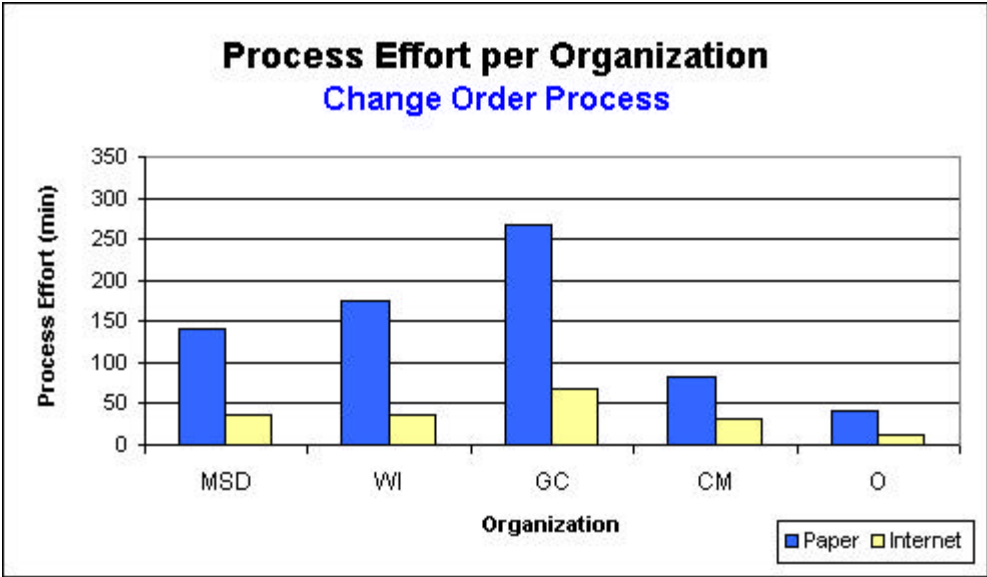

Figure C-3-b. *Comparison of processing effort per organization for the change order process with an paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

Organization	Paper (min)	% of Effort	Internet (min)	% of Effort
MSD	140	20%	38	20%
WI	176	25%	38	20%
GC	267	38%	67	36%
CM	83	12%	32	17%
O	41	6%	11	6%
TOTAL Processing Effort	**707**	**100%**	**186**	**100%**

Table C-3-b. *Distribution of processing effort per organization for each type of system.*

Organization	Paper (min)	Internet (min)	% Change
MSD	140	38	-73%
WI	176	38	-79%
GC	267	67	-75%
CM	83	32	-61%
O	41	11	-72%
TOTAL Processing Effort	**707**	**186**	**-74%**

Table C-3-c. *Percentage decrease in processing effort per organization due to an internet-based system.*

C.1.4. Analysis Results per Activity Skill

C.1.4.1. Total Number of Activities per Activity Skill

How many activities are managerial (e.g., approve change order), technical (e.g., calculate total amount requested), or clerical (e.g., enter cost code description) in the paper-based system and in the internet-based system?

How does the internet-based system affect each type of skill?

Paper-based process

- There are 133 managerial activities or 6% of the total activities.

- There are 103 technical activities or 5% of the total activities.

- There are 1952 clerical activities or 89% of the total activities.

Internet-based process

- The number of managerial activities would remain the same.

- The number of technical activities would remain the same.

- The number of clerical activities would be change by 235 activities. This would be a reduction of 12% in the number of activities over the paper-based system (Figure C-4-a).
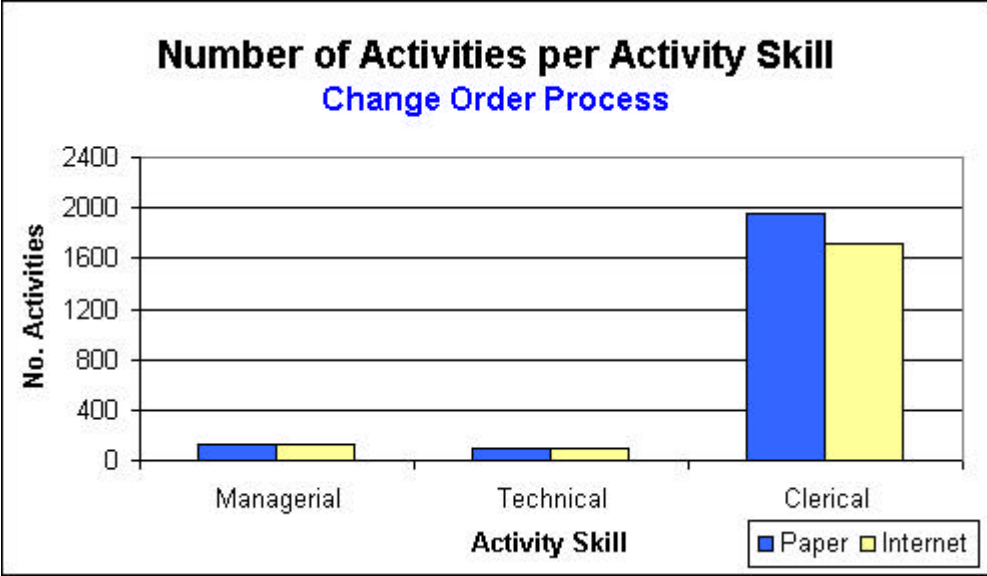
Figure C-4-a. *Comparison of activities per activity skill for the change order process with the paper-based system vs. an internet-based system.*

Activity Skill	Paper	% of Activities	Internet	% of Activities
Managerial	133	6%	133	7%
Technical	103	5%	103	5%
Clerical	1952	89%	1717	88%
TOTAL Number of Activities	2188	100%	1953	100%

Table C-4-a. *Distribution of activities per activity skill for each type of system.*

Activity Skill	Paper	Internet	% Change
Managerial	133	133	0%
Technical	103	103	0%
Clerical	1952	1717	-12%
TOTAL Number of Activities	2188	1953	-11%

Table C-4- b. Percentage decrease in activities due to an internet-based system.

C.1.4.2. Processing Effort per Activity Skill

How much effort does each type of skill (managerial, technical, or clerical) take for the change order process with the paper-based system vs. with an internet-based system?

How does the distribution of effort vary due to the internet-based system? (Ideally - the majority of the effort should be spent on managerial activities).

Paper-based process

- The managerial activities took 348 minutes or 49% of the total processing effort.

- The technical activities took 1 minute or 0.1% of the total processing effort.

- The clerical activities took 358 minutes or 51% of the total processing effort.

Internet-based process

- The managerial activities would take 163 minutes. The difference is 53% less effort than with the paper-based system. This results because the consistent and comprehensive documentation enforced by the system minimizes the need to negotiate the details of each change order request. This would now be 87% of the total processing effort! This would be a much better use of talent and skill.

- The technical activities would take 0 minutes or 0% of the total processing effort. This is a reduction of 100% in effort meaning they would all be automated.

- The clerical activities would take only 23 minutes or 13% of the total processing effort. This would be a reduction of 93% in effort (Figure C-4-b)! This is very close to the ideal scenario where 100% of the clerical activities would be automated or eliminated.
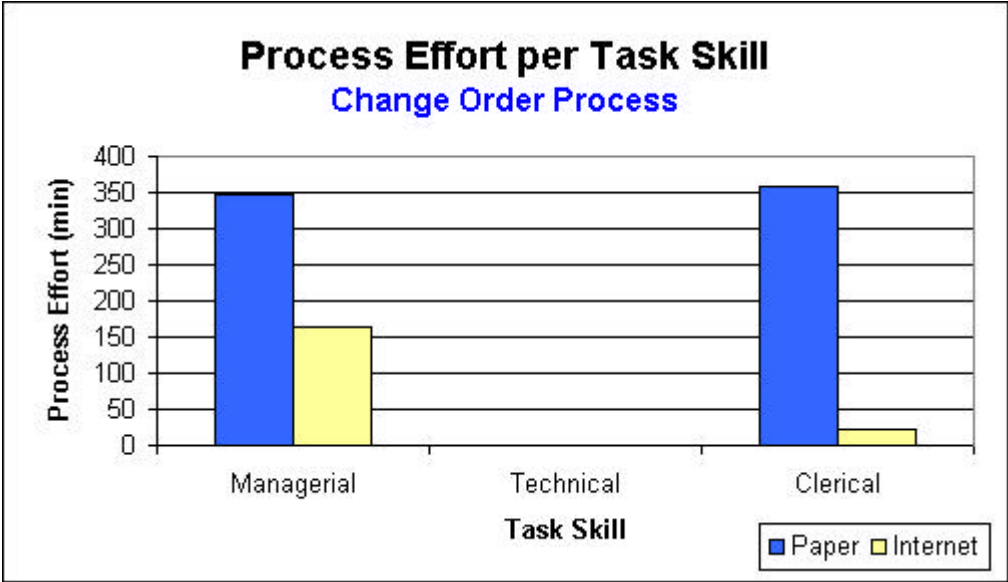
Figure C-4-b. *Comparison of processing effort per activity skill for the paper-based system vs. an internet-based system in the change order process.*

Activity Skill	Paper (min)	% of Effort	Internet (min)	% of Effort
Managerial	348	49%	163	87%
Technical	1	0.1%	0	0%
Clerical	358	51%	23	13%
TOTAL Processing Effort	707	100%	186	100%

Table C-4-c. *Distribution of processing effort per activity skill for each type of system.*

Appendix C. Change Order Process Analysis and Results

Activity Skill	Paper (min)	Internet (min)	% Change
Managerial	348	163	-53%
Technical	1	0	-100%
Clerical	358	23	-93%
TOTAL Processing Effort	707	186	-74%

Table C-4-d. Percentage decrease in processing effort per activity skill due to an internet-based system.

C.1.5. Analysis Results per Effect of Integration on Activity

C.1.5.1. Total Number of Activities per Effect on Activity

An internet-based system would affect the activities in the paper-based system in terms of processing effort. How many of these activities would remain the same? How many would be reduced? How many would be automated? How many would be eliminated?

From the paper-based process to the internet-based process

- There are 161 activities or 7% of the total activities that would remain the same in terms of processing effort (Figure C-5-a).

- There are 60 activities or 3% of the total activities that would be reduced.

- There are 1732 activities or 79% of the total activities that would be automated.

- There are 235 activities or 11% of the total activities that would be eliminated.
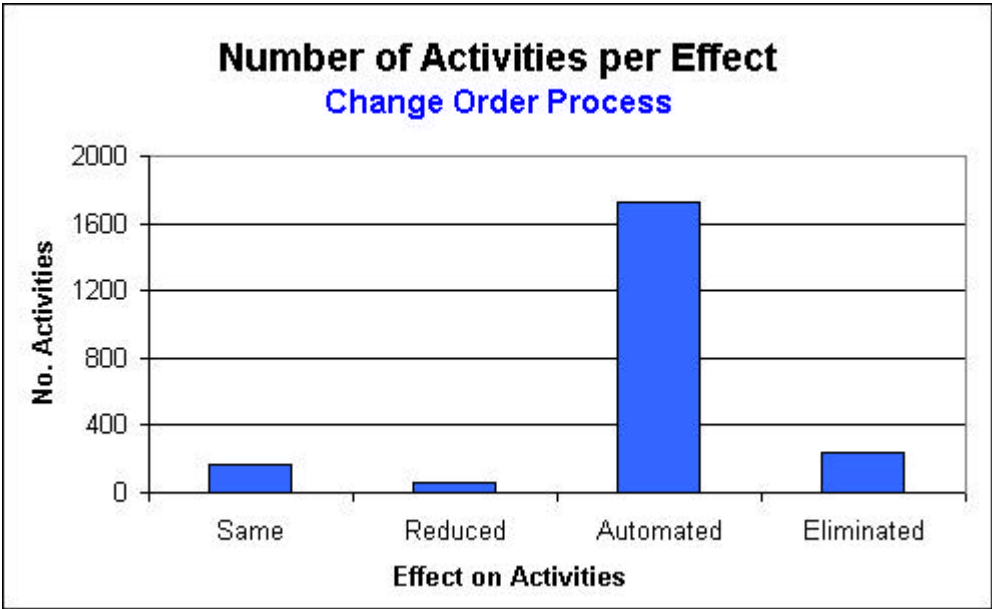
Figure C-5-a. *Distribution of activities per effect on activity for the change order process going from the paper-based system to the internet-based system.*

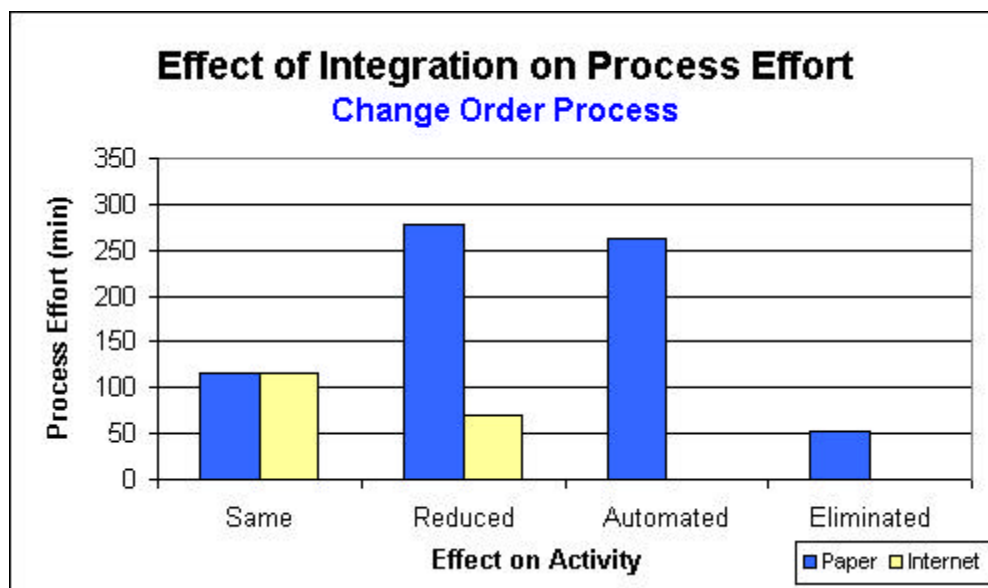| Effect	Paper	% of Activities	Internet
Same	161	7%	161
Reduced	60	3%	60
Automated	1732	79%	1732
Eliminated	235	11%	-
TOTAL Number of Activities	2188	100%	1953

Table C-5-a. *Distribution of activities per effect on activities.*

C.1.5.2. Processing Effort per Effect on Activity

An internet-based system would affect the activities in the paper-based system in terms of processing effort. How much effort would remain the same? How much effort would be reduced? How much effort would be automated? How much effort would be eliminated?

From the paper-based process to the internet-based process

- The effort for activities that stay the same would be 115 minutes or 16% of the total paper-based processing effort.

- The effort for activities that are reduced would drop from 278 minutes to 71 minutes or 40% of the total paper-based processing effort.

- The effort for activities that are automated would be 262 minutes or 37% of the total paper-based effort (Figure C-5-b).

- The effort for activities that are eliminated would be 52 minutes or 7% of the processing effort.

- Altogether, 314 minutes or 44% of the total processing effort would be automated or eliminated.

Figure C-5-b. *Distribution of processing effort per effect on activity for the change order process going from the paper-based system to an internet-based system.*

Effect	Paper (min)	% of Effort	Internet (min)	% of Effort
Same	115	16%	115	62%
Reduced	278	40%	71	38%
Automated	262	37%	0	0%
Eliminated	52	7%	0	0%
TOTAL Processing Effort	**707**	**100%**	**186**	**100%**

Table C-5-b. *Distribution of processing effort per effect on activities.*

C.1.6. Analysis Results per Activity Classification

C.1.6.1. Total Number of Activities per Activity Classification

How many activities were or would be used to prepare documents (e.g., create change order), to process documents (e.g., send change order), to authorize documents (e.g., review change order), to locate documents (e.g., archive change order), to update logs (e.g., enter amount requested), or to update the accounting database (e.g., enter cost code description) in the paper-based system and in an internet-based system?

How does an internet-based system affect each type of activity?

Paper-based process

- There were 729 activities to prepare documents or 33% of the total activities.

- There were 332 activities to process documents or 15% of the total activities.

- There were 58 activities to authorize documents or 3% of the total activities.

- There were 465 activities to locate documents or 21% of the total activities.

- There were 131 activities to update the accounting database or 6% of the total activities.

- There were 473 activities to update logs or 22% of the total activities.

Internet-based process

- The number of activities to prepare documents would decrease to 721, yet the percentage would rise to 37%.

- The number of activities to process documents would decrease to 275 activities, yet the percentage would decrease to 14%.

- The number of activities to authorize documents would stay the same, and the percentage would stay at 3%.

- The number of activities to locate documents would decrease to 295 or 15% of the total activities. (Figure C-6-a).

- The number of activities to update the accounting database would remain at 131, yet the percentage would increase to 7%.

- The number of activities to update the logs would remain at 473, and the percentage would rise to 24%.
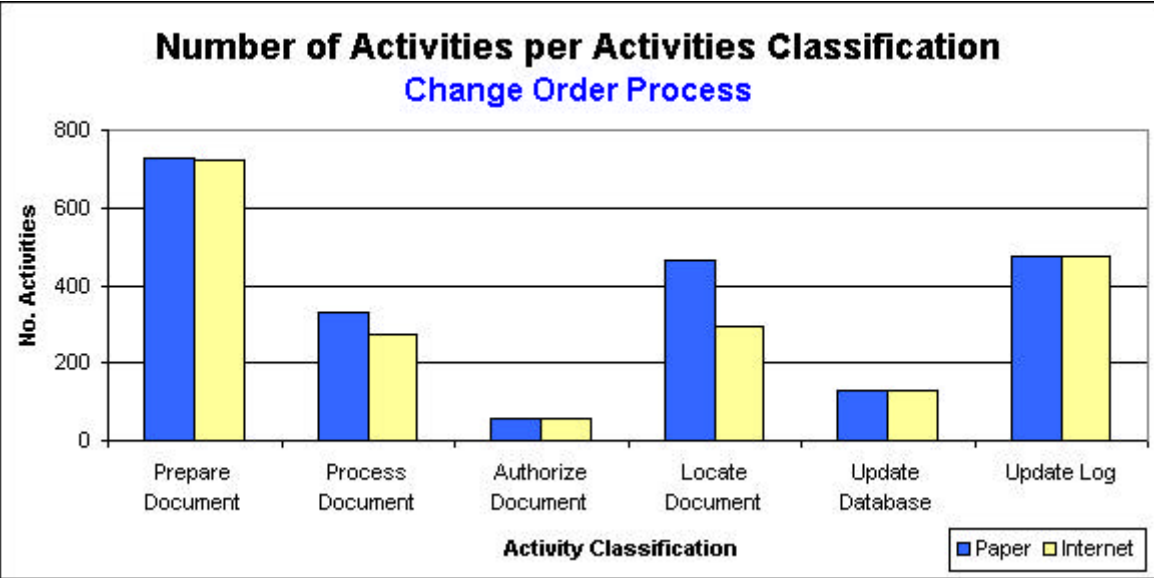
Figure C-6-a. *Comparison of activities per activity classification for the change order process with the paper-based system vs. an internet-based system.*

Activity Classification	Paper	% of Activities	Internet	% of Activities
Prepare Document	729	33%	721	37%
Process Document	332	15%	275	14%
Authorize Document	58	3%	58	3%
Locate Document	465	21%	295	15%
Update Database	131	6%	131	7%
Update Log	473	22%	473	24%
TOTAL Number of Activities	2188	100%	1953	100%

Table C-6-a. *Distribution of activities per activity classification for each type of system.*

C.1.6.2. Processing Effort per Activity Classification

How much processing effort was or would be required to prepare documents (e.g., create change order), to process documents (e.g., send change order), to authorize documents (e.g., review change order), to locate documents (e.g., archive change order), to update logs (e.g., enter amount requested), or to update the accounting database (e.g., enter cost code description) in the paper-based system and in an internet-based system?

How does the distribution of effort vary due to the internet-based system? (Ideally – the majority of the time should be on preparing documents). Where has the internet-based system the most impact?

Paper-based process

- The effort to prepare documents was 132 minutes or 19% of the total processing effort.

- The effort to process documents was 97 minutes or 14% of the total processing effort.

- The effort to authorize documents was 302 minutes or 43% of the total processing effort.

- The effort to locate documents was 82 minutes of or 12% of the total processing effort.

- The effort to update the accounting database was 24 minutes or 3% of the total processing effort.

- The effort to update the logs was 71 minutes of 10% of the total processing effort.

Internet-based process

- The effort to prepare documents would decrease by 72% to 37 minutes or 20% of the total processing effort.

- The effort to process documents would decrease to 87% to 13 minutes or 7% of the total processing effort.

- The effort to authorize documents would decrease by 60% to 121 minutes or 65% of the total processing effort.

- The effort to locate documents would decrease by 83% to 14 minutes or 8% of the total processing effort.

- The effort to update the accounting database would go to 0. All this effort would be automated (Figure C-6-b).

- The effort to update logs would decrease by 97% to 2 minutes or 1% of the total processing effort.
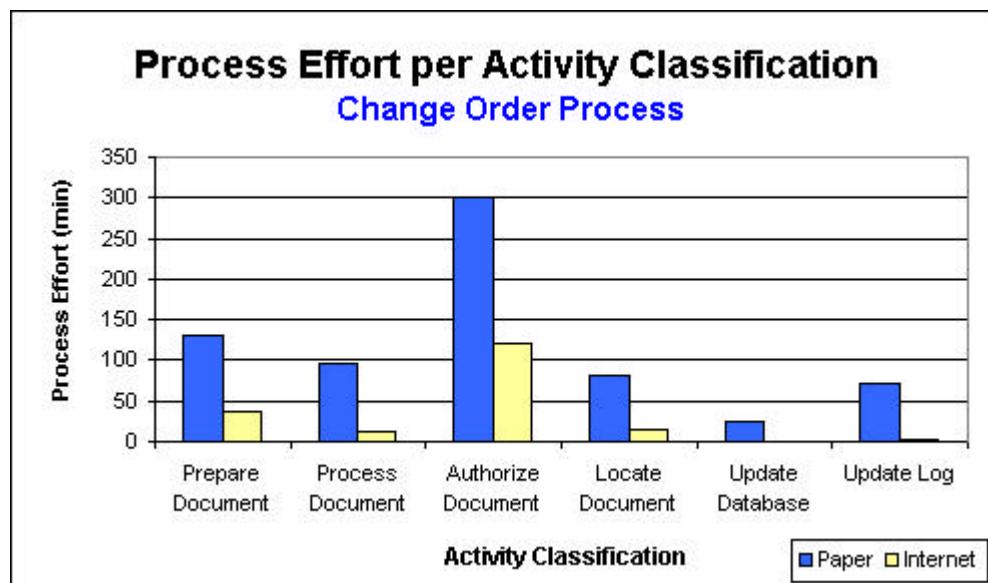
Figure C-6-b. *Comparison of processing effort per activity classification for the change order process with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

Activity Classification	Paper (min)	% of Effort	Internet (min)	% of Effort
Prepare Document	132	19%	37	20%
Process Document	97	14%	13	7%
Authorize Document	302	43%	121	65%
Locate Document	82	12%	14	8%
Update Database	24	3%	0	0%
Update Logs	71	10%	2	1%
TOTAL Processing Effort	707	100%	186	100%

Table C-6-b. Distribution of processing effort per activity classification for each type of system.

Activity Classification	Paper (min)	Internet (min)	% Change
Prepare Document	132	37	-72%
Process Document	97	13	-87%
Authorize Document	302	121	-60%
Locate Document	82	14	-83%
Update Database	24	0	-100%
Update Logs	71	2	-97%
TOTAL Processing Effort	707	186	-74%

Table C-6-c. Percentage decrease in processing effort per activity classification due to an internet-based system.

C.1.7. Analysis Results per Activity Level

C.1.7.1. Total Number of Activities per Activity Level

How many activities were at the document level vs. the information element level in the paper-based system and in an internet-based system?

<u>Paper-based process</u>

- There were 642 activities at the document level or 29% of the total activities.

- There were 1546 activities at the information element level or 71% of the total activities (Figure C-7-a).

<u>Internet-based process</u>

- The number of activities at the document level would decrease by 31% to 441 activities or 23% of the total activities.

- The number of activities at the information element level would decrease by 2% to 1512 activities or 77% of the total activities.
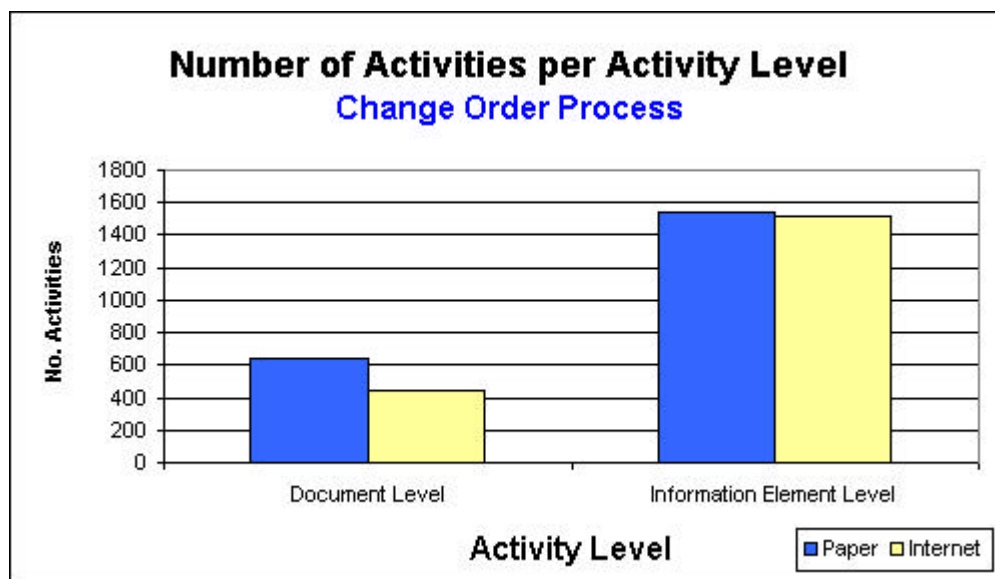

Figure C-7-a. *Comparison of activities per activity level for the change order process with the paper-based system vs. an internet-based system.*

Activity Level	Paper	% of Activities	Internet	% of Activities
Document Level	642	29%	441	23%
Information Element Level	1546	71%	1512	77%
TOTAL Number of Activities	2188	100%	1953	100%

Table C-7-a. *Distribution of activities per activity level for each type of system.*

Activity Level	Paper	Internet	% Change
Document Level	642	441	-31%
Information Element Level	1546	1512	-2%
TOTAL Number of Activities	2188	1953	-11%

Table C-7-b. *Percentage decrease in activities per activity level due to an internet-based system.*

C.1.7.2. Total Processing effort per Activity Level

How much processing effort is used at the document level vs. the information element level in the paper-based system and in an internet-based system?

Paper-based process

- The processing effort was 443 minutes or 7.4 hours at the document level or 63% of the total processing effort.

- The processing effort was 264 minutes or 4.4 hours at the information element level or 37% of the total processing effort.

Internet-based process

- The processing effort at the document level would decrease by 72% to 134 minutes or 2.2 hours or 72% of the total processing effort (Figure C-7-b).

- The processing effort at the information element level would decrease by 80% to 52 minutes or 28% of the total processing effort.
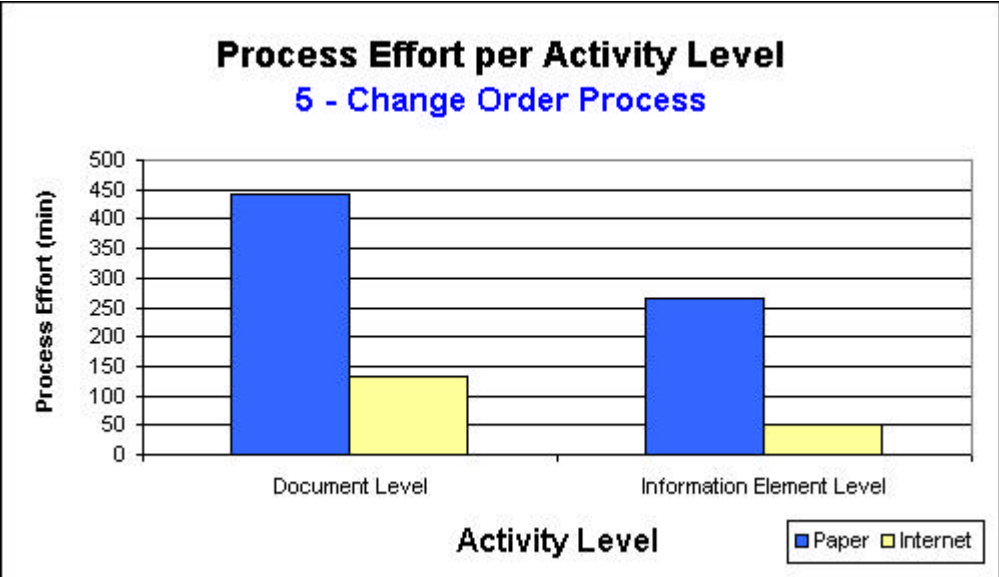

Figure C-7-b. *Comparison of processing effort per activity level for the change order process with the paper-based system vs. an internet-based system.*

Activity Level	Paper (min)	% of Activities	Internet (min)	% of Activities
Document Level	443	63%	134	72%
Information Element Level	264	37%	52	28%
TOTAL Processing Effort	707	100%	186	100%

Table C-7-c. *Distribution of processing effort per activity level for each type of system.*

Activity Level	Paper (min)	Internet (min)	% Change
Document Level	443	134	-70%
Information Element Level	264	52	-80%
TOTAL Processing Effort	707	186	-74%

Table C-7-d. *Percentage decrease in processing effort change per activity level due to internet-based system.*

C.1.8. Analysis Results per Source of Information Elements

C.1.8.1. Number of Activities per Source of Information Elements

How many activities at the information element level in the paper-based system require new information entry (DATA!) vs. activities whose information can be automatically generated (AUTO!), calculated (CALC!), or obtained from another process and in an internet-based system?

If the information can be obtained from another process, what is its source?

Paper-based process

- Of the 1546 activities at the information element level:

    - 48 activities or 3% required new information entry.

    - 117 activities or 8% used information an internet-based system could generate automatically (e.g., enter document date).

    - 103 activities or 7% used information an internet-based system could calculate automatically (e.g., calculate total $Amount Requested).

    - 290 activities or 19% used information an internet-based system could obtain automatically from function categories S1, G1 and O1 "Setup Project" (e.g., enter project name).

    - 14 activities or 1% used information an internet-based system could obtain automatically from function categories S2 and G2 "Scope Management" (e.g., enter cost code description).

    - 39 activities or 3% used information an internet-based system could obtain automatically from function categories S3 and G3 "Manage Documents" (e.g., enter RFI Description).

    - 152 activities or 10% used information an internet-based system could obtain automatically from the function category S4 "Manage Field Resources" (e.g., enter cost code ID).

    - 731 activities or 47% used information an internet-based system could obtain automatically from within the function categories S5, G5, and O5 "Manage Change Orders" (e.g., enter Change Order Item No).

    - 52 activities or 4% used information an internet-based system could obtain automatically from function categories S8 and G8 "Manage Reports" (e.g., find Material Vendor ID).

Internet-based process

- Of the 1546 activities at the information element level:

    - The number of activities whose source would be S5, G5, or O5 would decrease by 5% to 697 activities or 46% of the activities at the information level (Figure C-8-a).

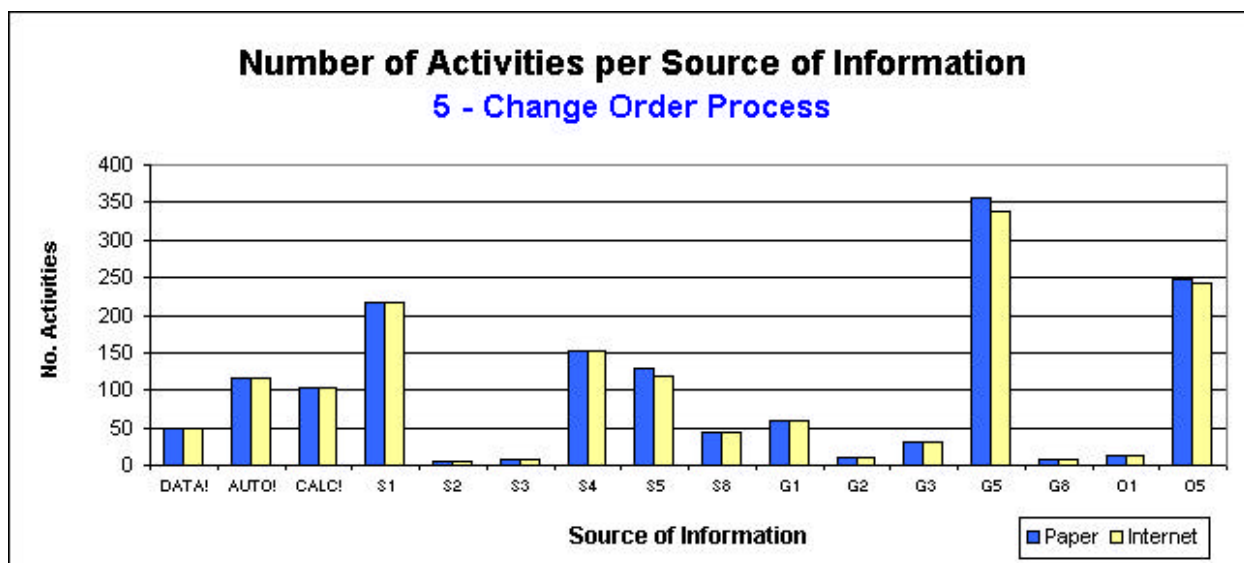   - All other activities remain the same as in the paper-based system.

Figure C-8-a. *Comparison of activities per source of information for the change order process for activities at the information element level in the paper-based system vs. an internet-based system.*

Source of Information	Paper	% of Activities	Internet	% of Activities
DATA!	48	3%	48	3%
AUTO!	117	8%	117	8%
CALC!	103	7%	103	7%
S1	217	14%	217	14%
S2	4	0%	4	0%
S3	8	1%	8	1%
S4	152	10%	152	10%
S5	128	8%	118	8%
S8	44	3%	44	3%
G1	59	4%	59	4%
G2	10	1%	10	1%
G3	31	2%	31	2%
G5	355	23%	337	22%
G8	8	1%	8	1%
O1	14	1%	14	1%
O5	248	16%	242	16%
TOTAL Number of Activities	1546	100%	1512	100%

Table C-8-a. *Distribution of activities per source of information for each type of system.*

Source of Information	Paper	Internet	% Change
DATA!	48	48	0%
AUTO!	117	117	0%
CALC!	103	103	0%
S1	217	217	0%
S2	4	4	0%
S3	8	8	0%
S4	152	152	0%
S5	128	118	-8%
S8	44	44	0%
G1	59	59	0%
G2	10	10	0%
G3	31	31	0%
G5	355	337	-5%
G8	8	8	0%
O1	14	14	0%
O5	248	242	-2%
TOTAL Number of Activities	1546	1512	-2%

Table C-8-b. *Percentage decrease in activities per source of information due to an internet-based system.*

C.1.8.2. Processing Effort per Source of Information Elements

How much processing effort was used at the information element level in the paper-based system to enter new information (DATA!) and in the internet-based system?

How much processing effort is used for activities whose information could be automatically generated (AUTO!), calculated (CALC!), or obtained from another process (i.e., S1, S5, G5, etc.)?

Paper-based process

- The processing effort was 264 minutes for activities at the information element level. Of this amount:

    - 36 minutes or 14% was for activities that required new information entry.

    - 11 minutes or 4% was for activities that could automatically generate the information (e.g., enter document date).

    - 1 minute or 0.3% was for activities that calculate information (e.g., calculate total RT labor hours).

    - 37 minutes or 14% was for activities whose information comes from function categories S1, G1, and O1 "Setup Project" (e.g., project name).

    - 4 minutes or 1% was for activities whose information comes from function categories S2 and G2 "Scope Management" (e.g., cost codes).

    - 18 minutes or 7% was for activities whose information comes from function categories S3 and G3 "Manage Documents" (e.g., get RFI No.).

    - 40 minutes or 15% was for activities whose information comes from within the function category S4 "Manage Field Resources" (e.g., RT labor hours total per day).

    - 110 minutes or 42% was for activities whose information comes from within the function categories S5, G5, and O5 "Manage Change Orders" (e.g., Enter Sub Change Order $Amount Requested).

Internet-based process

- The processing effort would be 52 minutes for activities at the information element level. Of this amount:

    - 33 minutes or 63% would be for activities that require new information entry. This would be closer to the ideal, which would be 100%.

    - 3 minutes or 5% would be for activities whose information comes from function category G2 "Scope Management" (e.g., cost codes). These types of activities would be integrated, yet would still require manual selection.

    - 5 minutes or 10% would be for activities whose information would come from function category G3 "Manage Documents" (e.g., Read Contract Section).

    - 9 minutes or 18% would be for activities whose information would come from function category G5 "Manage Change Orders" (e.g., Execute Sub Change Order).

    - 2 minutes or 3% would be for activities whose information would come from function category O5 "Manage Change Orders" (e.g., Prepare Owner Change Order).

- All other activities would be automated or eliminated, thus their time would be reduced to 0 (Figure C-8-b).
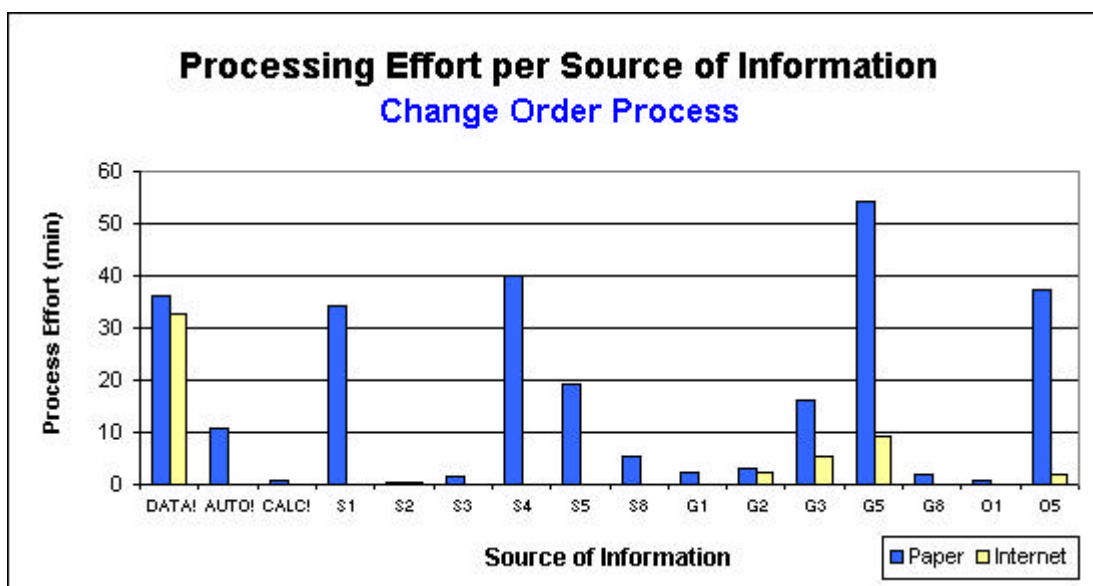
Figure C-8-b. *Comparison of processing effort per source of information for activities at the information element level for the change order process with the paper-based system vs. an internet-based system.*

Source of Information	Paper (min)	% of Effort	Internet (min)	% of Effort
DATA!	36	14%	33	63%
AUTO!	11	4%	0	0%
CALC!	1	0.3%	0	0%
S1	34	13%	0	0%
S2	0	0%	0	1%
S3	2	1%	0	0%
S4	40	15%	0	0%
S5	19	7%	0	0%
S8	5	2%	0	0%
G1	3	1%	0	0%
G2	3	1%	3	5%
G3	16	6%	5	10%
G5	54	20%	9	18%
G8	2	1%	0	0%
O1	1	0%	0	0%
O5	37	14%	2	3%
TOTAL Processing Effort	**264**	**100%**	**52**	**100%**

Table C-8-c. *Distribution of processing effort per source of information for each type of system.*

Appendix C. Change Order Process Analysis and Results

Source of Information	Paper (min)	Internet (min)	% Change
DATA!	36	33	-9%
AUTO!	11	0	-100%
CALC!	1	0	-100%
S1	34	0	-100%
S2	0	0	0%
S3	2	0	-89%
S4	40	0	-100%
S5	19	0	-99%
S8	5	0	-100%
G1	3	0	-100%
G2	3	3	-21%
G3	16	5	-68%
G5	54	9	-83%
G8	2	0	-100%
O1	1	0	-100%
O5	37	2	-95%
TOTAL Processing Effort	264	52	-80%

Table C-8-d. *Percentage decrease in processing effort per source of information due to an internet-based system.*

The ideal scenario would be that 100% of the activities either require new information or that the system would prompt the user to select from a list of values so that information would not be re-entered, but only selected.

C.1.9. Analysis Results per Data Type of Information Elements

C.1.9.1. Number of Activities per Data Type of Information Elements

How many information elements were of each data type - $ Amount, Date, Hyperlink, ID, Number, Signature, Text, or Time in the paper-based system and in the internet-based system?

<u>Paper-based process</u>

- Of the 1546 information elements:
    - 284 or 18% were "$ Amounts".
    - 173 or 11% were "Dates".
    - 12 or 1% were "Hyperlinks" (references to other documents).
    - 275 or 18% were alphanumeric "IDs".
    - 335 or 22% were "Numbers".
    - 9 or 1% were "Signatures".
    - 449 or 29% were "Text" elements.
    - 9 or 1% were "Time" elements.

<u>Internet-based process</u>

- Of the 1512 information elements:
    - The number of "Dates" would decrease by 20% to 139 "Dates" or 9% of the information elements.
    - All other data types would remain the same as in the paper-based system (Figure C-9-a).
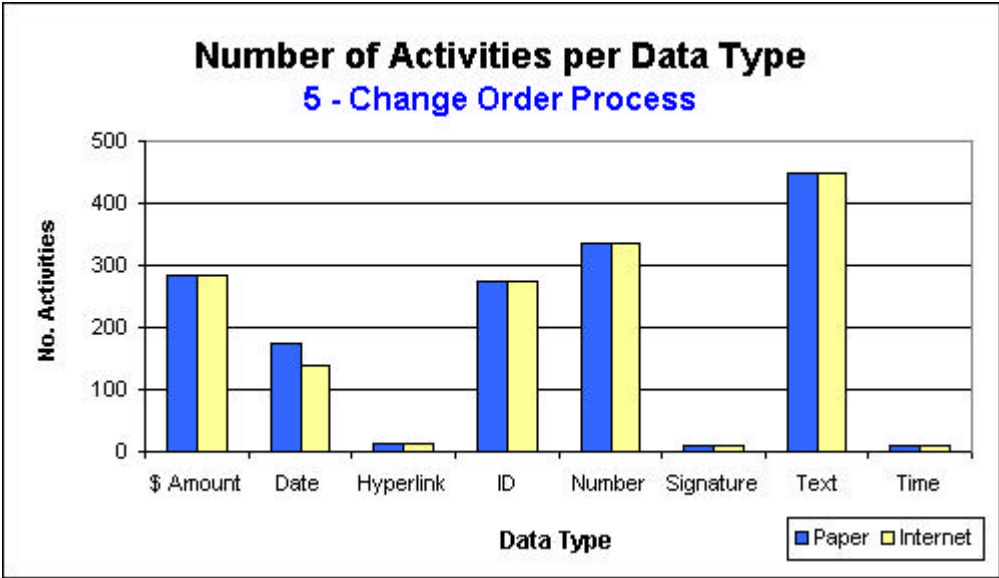
Figure C-9-a. *Comparison of activities per data type for activities at the information element level for the change order process with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

Data Type	Paper	% of Activities	Internet	% of Activities
$ Amount	284	18%	284	19%
Date	173	11%	139	9%
Hyperlink	12	1%	12	1%
ID (alphanumeric)	275	18%	275	18%
Number	335	22%	335	22%
Signature (encrypted text)	9	1%	9	1%
Text	449	29%	449	30%
Time	9	1%	9	1%
TOTAL Number of Activities	1546	100%	1512	100%

Table C-9-a. *Distribution of activities per data type for each type of system.*

Data Type	Paper	Internet	% Change
$ Amount	284	284	0%
Date	173	139	-20%
Hyperlink	12	12	0%
ID (alphanumeric)	275	275	0%
Number	335	335	0%
Signature (encrypted text)	9	9	0%
Text	449	449	0%
Time	9	9	0%
TOTAL Number of Activities	1546	1512	-2%

Table C-9-b. *Percentage decrease in activities per data type due to an internet-based system.*

C.1.9.2. Processing Effort per Data Type of Information Elements

How much processing effort was used per data type in the paper-based system and in an internet-based system?

*What data types are most or least affected by the internet-based process in terms of processing effort?*

Please note: The results given here are in terms of the processing effort for information elements only. It is not the total processing effort which includes activities at the document level also.

Paper-based process

- The processing effort for "$ Amounts" was 33 minutes or 12% of the processing effort.

- The processing effort for "Dates" was 33 minutes or 12% of the processing effort.

- The processing effort for "Hyperlinks" was 2 minutes or 1% of the processing effort.

- The processing effort for "IDs" was 51 minutes or 19% of the processing effort.

- The processing effort for "Numbers" was 51 minutes or 17% of the processing effort.

- The processing effort for "Signatures" was 1 minute or 0.4% of the processing effort.

- The processing effort for "Text" elements was 93 minutes or 35% of the processing effort.

- The processing effort for "Time" elements was 1 minute or 0.3% of the processing effort.

Internet-based process

- The processing effort for "$ Amounts" would decrease by 94% to 2 minutes or 4% of the processing effort.

- The processing effort for "Dates" would decrease by 99% to 0.3 minutes or 0.5% of the processing effort.

- The processing effort for "Hyperlinks" would decrease by 58% to 1 minute or 2% of the processing effort.

- The processing effort for "IDs" would decrease by 85% to 8 minutes or 15% of the processing effort.

- The processing effort for "Numbers" would decrease by 94% to 3 minutes or 5% of the total processing effort (Figure C-9-b).

- The processing effort for "Signatures" would remain the same.

- The processing effort for "Text" elements would decrease by 60% to 38 minutes or 72% of the processing effort.

- The processing effort for "Time" elements would be completely automated.
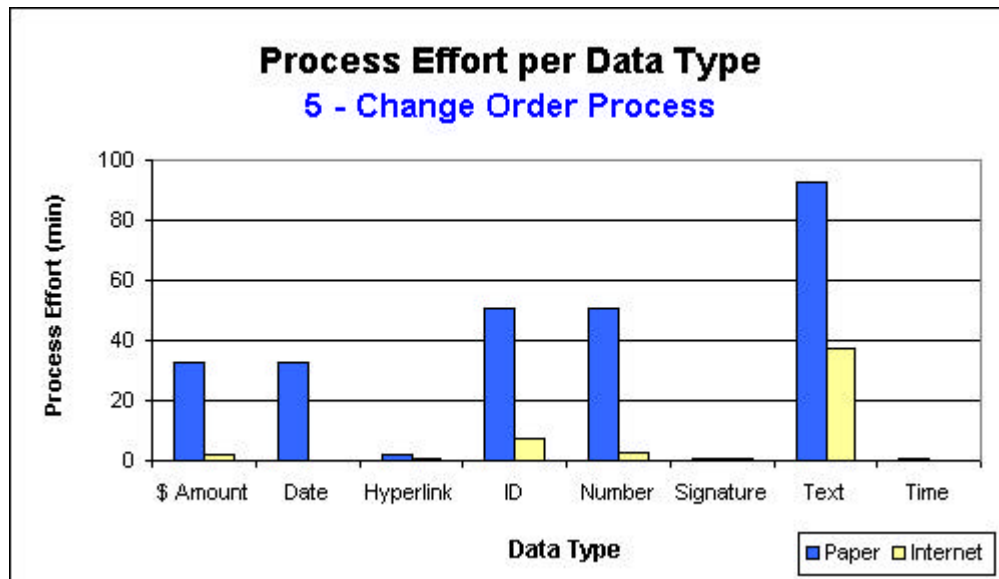
Figure C-9-b. *Comparison of processing effort per data type for activities at the information element level for the change order process with the paper-based system vs. an internet-based system.*

Data Type	Paper (min)	% of Effort	Internet (min)	% of Effort
$ Amount	33	12%	1.8	4%
Date	33	12%	0.3	0.5%
Hyperlink	2	1%	0.9	2%
ID (alphanumeric)	51	19%	7.7	15%
Number	51	19%	2.8	5%
Signature (encrypted text)	1	0.4%	1.0	2%
Text	93	35%	37.5	72%
Time	1	0.3%	0.0	0.0%
TOTAL Processing Effort	264	100%	52	100%

Table C-9-c. *Distribution of processing effort per data type for each type of system.*

Data Type	Paper (min)	Internet (min)	% Change
$ Amount	33	1.8	-94%
Date	33	0.3	-99%
Hyperlink	2	0.9	-58%
ID (alphanumeric)	51	7.7	-85%
Number	51	2.8	-94%
Signature (encrypted text)	1	1.0	0%
Text	93	37.5	-60%
Time	1	0.0	-100%
TOTAL Processing Effort	264	52	-80%

Table C-9-d. *Percentage decrease in processing effort per data type due to an internet-based system.*

C.2. Results of Change Order Process Analysis - Multi-Parameter

We now compare two parameters at a time from four different parameters to analyze the impact of an internet-based system: organization, activity skill, effect on activity, and activity classification. This is useful to understand the relationships between these different parameters modeled and how they would be affected by an internet-based system.

C.2.1. Distribution per Organization

The following sections discuss the distribution of activities and processing effort per organization in terms of the three other parameters: activity skill, effect on activity, and activity classification.

C.2.1.1. Distribution by Activity Skill per Organization

C.2.1.1.1. Distribution of Number of Activities by Activity Skill per Organization

How does the number of activities by type of skill (managerial, technical, or clerical) vary for each organization in the change order process with the paper-based system vs. an internet-based system?

When the total number of activities is distributed by activity skill for each organization, we observe the following:

Paper-based process

- The distribution of activities for the MSD sub is as follows: 6% managerial, 9% technical, and 85% clerical activities (Figure C-10-a).

- The distribution of activities for the WI sub is as follows: 4% managerial, 9% technical, and 87% clerical activities.

- The distribution of activities for the GC is as follows: 8% managerial, 1% technical, and 91% clerical activities.

- The distribution of activities for the CM is as follows: 10% managerial, 0% technical, and 90% clerical activities.

- The distribution of activities for the O is as follows: 5% managerial, 1% technical, and 94% clerical activities.

Internet-based process

- The distribution of activities for the MSD sub would now be as follows: 7% managerial, 10% technical, and 83% clerical activities (Figure C-10-a).

- The distribution of activities for the WI sub would now be as follows: 5% managerial, 10% technical, and 85% clerical activities.

- The distribution of activities for the GC would now be as follows: 8% managerial, 2% technical, and 90% clerical activities.

- The distribution of activities for the CM would now be as follows: 10% managerial, 0% technical, and 90% clerical activities.

- The distribution of activities for the O would now be as follows: 5% managerial, 1% technical, and 94% clerical activities.
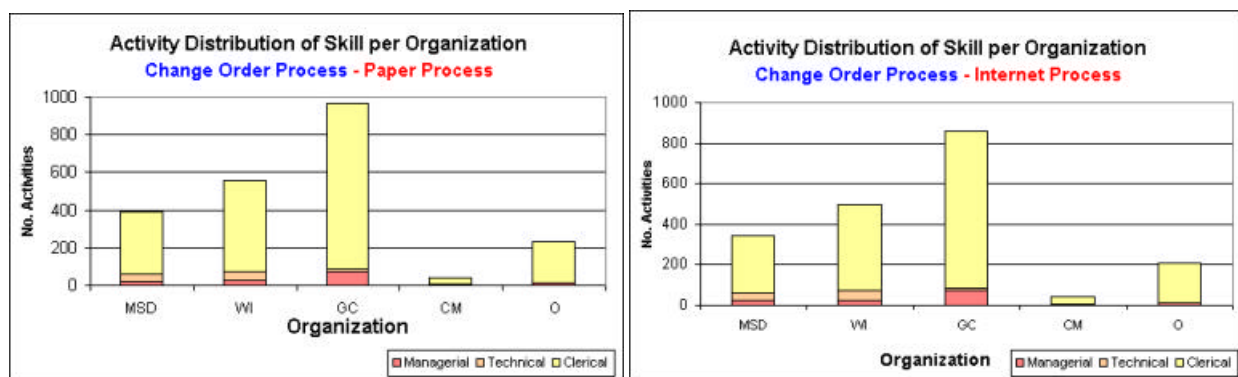
Figure C-10-a, b. *Distribution of activities by activity skill per organization for the change order process with the paper-based system vs. an internet-based system.*

WI	Activity Skill - Number of Activities							
	Paper				Internet			
Organization	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
MSD	23	36	330	**389**	23	36	287	**346**
WI	24	51	481	**556**	24	51	425	**500**
GC	71	14	885	**970**	71	14	771	**856**
CM	4	0	37	**41**	4	0	37	**41**
O	11	2	219	**232**	11	2	197	**210**
TOTAL	**133**	**103**	**1952**	**2188**	**133**	**103**	**1717**	**1953**

Table C-10-a. *Number of activities by activity skill per organization for each type of system.*

WI	Activity Skill - Number of Activities (%)							
	Paper				Internet			
Organization	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
MSD	6%	9%	85%	**100%**	7%	10%	83%	**100%**
WI	4%	9%	87%	**100%**	5%	10%	85%	**100%**
GC	8%	1%	91%	**100%**	8%	2%	90%	**100%**
CM	10%	0%	90%	**100%**	10%	0%	90%	**100%**
O	5%	1%	94%	**100%**	5%	1%	94%	**100%**

Table C-10-b. *Distribution of activities by activity skill per organization for each type of system.*

C.2.1.1.2. Distribution of Processing Effort by Activity Skill per Organization

How does the processing effort by type of skill (managerial, technical, or clerical) vary for each organization for the change order process with the paper-based system vs. an internet-based system?

When the processing effort is distributed by activity skill for each organization, we observe the following:

Paper-based process

- The distribution of processing effort for the MSD sub is as follows: 59% managerial, 1% technical, and 40% clerical.

- The distribution of processing effort for the WI sub is as follows: 47% managerial, 0% technical, 53% clerical.

- The distribution of processing effort for the GC is as follows: 38% managerial, 0% technical, and 62% clerical.

- The distribution of processing effort for the CM is as follows: 93% managerial, 0% technical, and 7% clerical.

- The distribution of processing effort for the O is as follows: 12% managerial, 0% technical, and 88% clerical.

Internet-based process

- The distribution of processing effort for the MSD sub would be as follows: 96% managerial, 0% technical, and 4% clerical.

- The distribution of processing effort for the WI sub would be as follows: 97% managerial, 0% technical, 3% clerical.

- The distribution of processing effort for the GC would be as follows: 80% managerial, 0% technical, and 20% clerical.

- The distribution of processing effort for the CM would be as follows: 98% managerial, 0% technical, and 2% clerical.

- The distribution of processing effort for the Owner would be as follows: 42% managerial, 0% technical, and 58% clerical.
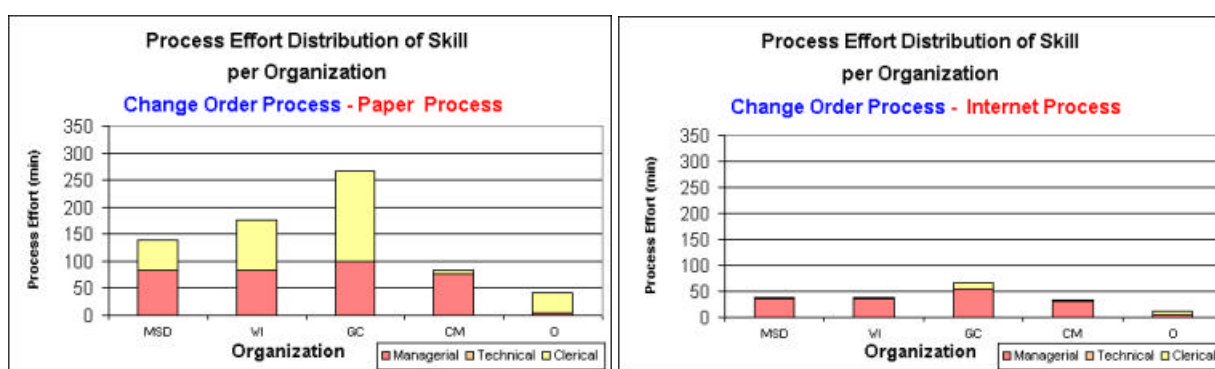

Figure C-10-c, d. *Distribution of processing effort by activity skill per organization for the change order process with the paper-based system vs. an internet-based system.*

| WI | Activity Skill - Processing Effort (min) | | | | | | | |
| | Paper | | | | Internet | | | |
Organization	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
MSD	83	1	57	140	36	0	1	38
WI	83	0	93	176	36	0	1	38
GC	101	0	166	267	54	0	14	67
CM	77	0	6	83	32	0	1	32
O	5	0	36	41	5	0	7	11
TOTAL	348	1	358	707	163	0	23	186

Table C-10-c. *Processing effort by activity skill per organization for each type of system.*

| WI | Activity Skill - Processing Effort (%) | | | | | | | |
| | Paper | | | | Internet | | | |
Organization	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
MSD	59%	1%	40%	100%	96%	0%	4%	100%
WI	47%	0%	53%	100%	97%	0%	3%	100%
GC	38%	0%	62%	100%	80%	0%	20%	100%
CM	93%	0%	7%	100%	98%	0%	2%	100%
O	12%	0%	88%	100%	42%	0%	58%	100%

Table C-10-d. *Distribution of processing effort by activity skill per organization for each type of system.*

| WI | Activity Skill - Processing Effort (min) | | | | | | | | |
| | Managerial | | | Technical | | | Clerical | | |
Organization	Paper	Internet	% Change	Paper	Internet	% Change	Paper	Internet	% Change
MSD	83	36	-56%	1	0	-100%	57	1	-97%
WI	83	36	-56%	0	0	-	93	1	-99%
GC	101	54	-47%	0	0	-	166	14	-92%
CM	77	32	-59%	0	0	-	6	1	-89%
O	5	5	-2%	0	0	-	36	7	-82%
TOTAL	348	163	-53%	1	0	-100%	358	23	-93%

Table C-10-e. *Percentage of processing effort by activity skill per organization change due to internet-based system.*

C.2.1.2. Distribution by Effect on Activity per Organization

C.2.1.2.1. Distribution of Number of Activities by Effect per Organization

An internet-based system would affect the processing effort of activities with the paper-based system. For each organization, how many activities would remain the same? How many activities would be reduced? How many activities would be automated? How many activities would be eliminated?

When the total number of activities is distributed by effect on activity for each organization, we observe the following:

From the paper-based process to the internet-based process

- Of The MSD sub's number of activities, 5% would remain the same, 3% would be reduced, 81% would be automated, and 11% would be eliminated.

- Of The WI sub's number of activities, 3% would remain the same, 2% would be reduced, 85% would be automated, and 10% would be eliminated.

- Of the GC's number of activities, 10% would remain the same, 3% reduced, 75% would be automated, and 12% would be eliminated.

- Of the CM's number of activities, 13% would remain the same, 2% reduced, 85% would be automated, and 0% would be eliminated.

- Of the O's number of activities, 9% would remain the same, 2% reduced, 80% would be automated, and 9% would be eliminated.
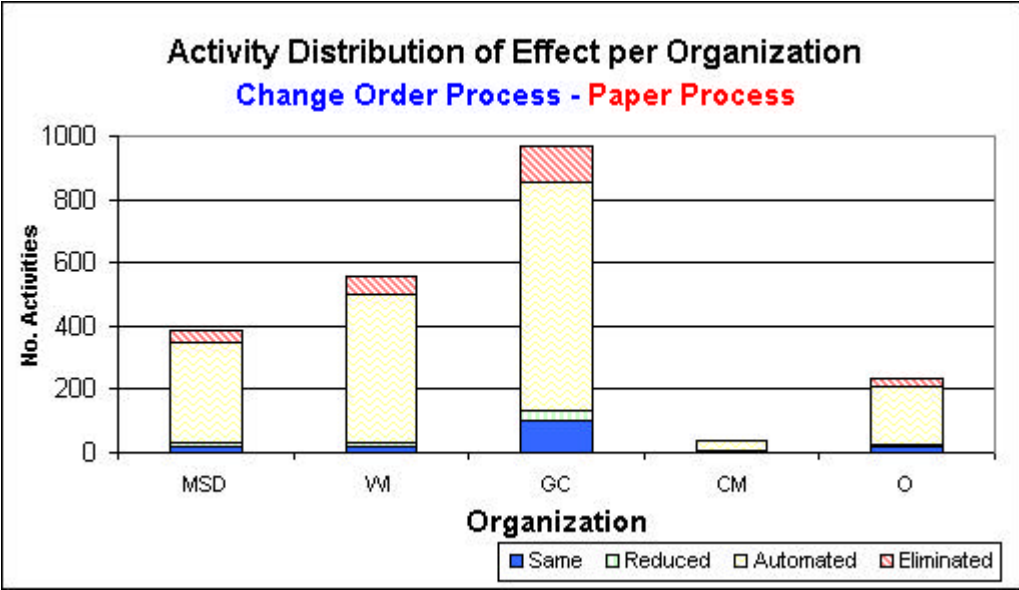

Figure C-11-a. *Distribution of activities by effect on activity per organization for the change order process with the paper-based system vs. an internet-based system.*

WI	Effect - Number of Activities				
Organization	Same	Reduced	Automated	Eliminated	TOTAL
MSD	18	12	316	43	389
WI	18	12	470	56	556
GC	99	32	725	114	970
CM	5	1	35	0	41
O	21	3	186	22	232
TOTAL	161	60	1732	235	2188

Table C-11-a. *Number of activities by effect on activity per organization.*

WI	Effect - Number of Activities (%)				
Organization	Same	Reduced	Automated	Eliminated	TOTAL
MSD	5%	3%	81%	11%	100%
WI	3%	2%	85%	10%	100%
GC	10%	3%	75%	12%	100%
CM	13%	2%	85%	0%	100%
O	9%	2%	80%	9%	100%

Table C-11-b. *Distribution of activities by effect on activity per organization.*

C.2.1.2.2. Distribution of Processing Effort of Effect per Organization

An internet-based system would affect the processing effort of activities with the paper-based system. What would be the effect on each organization's processing effort? How much effort would remain the same? How much effort would be reduced? How much effort would be automated? How much effort would be eliminated?

When the total processing effort is distributed by effect on activity for each organization, we observe the following:

From the paper-based process to the internet-based process

- Of The MSD sub's processing effort, 14% would remain the same, 47% would be reduced, 32% would be automated, and 6% would be eliminated.

- Of The WI sub's processing effort, 11% would remain the same, 38% would be reduced, 44% would be automated, and 6% would be eliminated.

- Of the GC's processing effort, 17% would remain the same, 31% would be reduced, 40% would be automated, and 11% would be eliminated.

- Of the CM's processing effort, 21% would remain the same, 72% would be reduced, 7% would be automated, and 0% would be eliminated.

- Of the O's processing effort, 26% would remain the same, 5% would be reduced, 60% would be automated, and 9% would be eliminated.
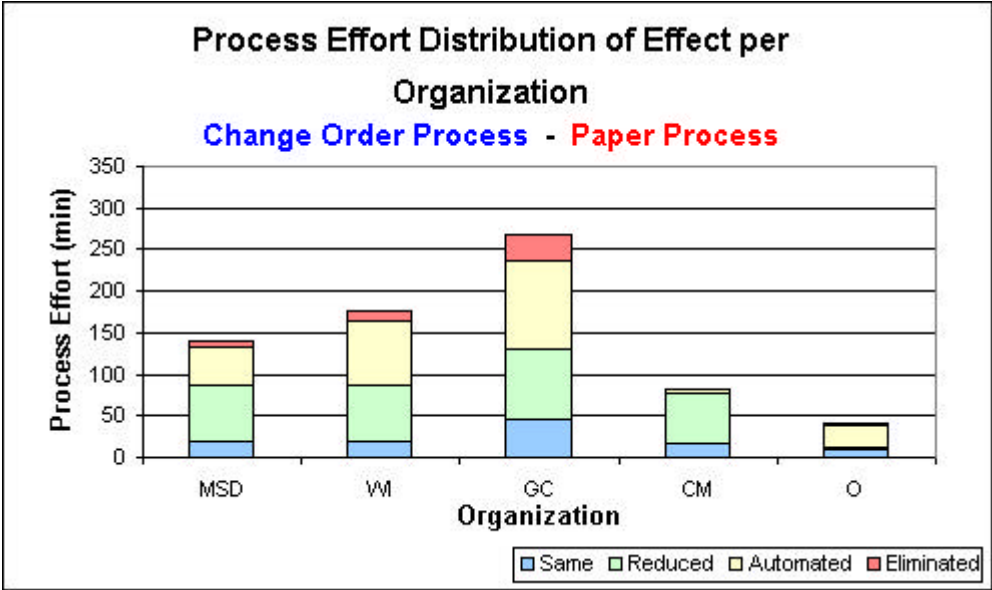

Figure C-11-b. *Distribution of processing effort by effect on activity per organization for the change order process due to the paper-based system vs. an internet-based system.*

WI	Effect - Processing Effort (min)				
Organization	Same	Reduced	Automated	Eliminated	TOTAL
MSD	20	67	46	8	140
WI	20	67	78	11	176
GC	47	83	108	29	267
CM	17	60	6	0	83
O	11	2	25	4	41
TOTAL	115	278	262	52	707

Table C-11-c. *Processing effort by effect on activity per organization.*

WI	Effect - Processing Effort (%)				
Organization	Same	Reduced	Automated	Eliminated	TOTAL
MSD	14%	47%	32%	6%	100%
WI	11%	38%	44%	6%	100%
GC	17%	31%	40%	11%	100%
CM	21%	72%	7%	0%	100%
O	26%	5%	60%	8%	100%

Table C-11-d. *Distribution of processing effort by effect on activity per organization.*

C.2.1.3. Distribution by Activity Classification per Organization

C.2.1.3.1. Distribution of Number of Activities by Activity Classification per Organization

How many activities would each organization use to prepare documents (e.g., create COR), to process documents (e.g., send COR), to authorize documents (e.g., negotiate COR), to locate documents (e.g., archive CO), or to update the accounting database (e.g., enter cost code description) in the paper-based system vs. in an internet-based system?

When the total number of activities is distributed by organization for each type of effect on activity, we observe the following:

Paper-based process

- The MSD sub used 52% of his activities to prepare documents, 14% to process documents, 4% to authorize documents, 16% to locate (archive) documents, 3% to update the accounting database, and 12% to update logs.

- The WI sub used 52% of his activities to prepare documents, 14% to process documents, 3% to authorize documents, 21% to locate (archive) documents, 2% to update the database, and 8% to update logs.

- The GC used 17% of his activities to prepare documents, 17% to process documents, 2% to authorize documents, 26% to locate (archive) documents, 7% to update the database, and 30% to update logs.

- The CM used 10% of his activities to prepare documents, 27% to process documents, 5% to authorize documents, 0% to locate (archive) documents, 0% to update the database, 59% to update logs.

- The O used 29% of his activities to preapre documents, 10% to process documents, 2% to authorize documents, 14% to locate (archive) documents, 16% to update the database, 28% to update logs.

Internet-based process

- The MSD sub would use 58% of his activities to prepare documents, 13% to process documents, 4% to authorize documents, 10% to locate (archive) documents, 3% to update the accounting database, and 13% to update logs.

- The WI sub would use 58% of his activities to prepare documents, 11% to process documents, 3% to authorize documents, 17% to locate (archive) documents, 2% to update the database, and 9% to update logs.

- The GC would use 19% of his activities to prepare documents, 17% to process documents, 3% to authorize documents, 19% to locate (archive) documents, 8% to update the database, and 34% to update logs.

- The CM would use 10% of his activities to prepare documents, 27% to process documents, 5% to authorize documents, 0% to locate (archive) documents, 0% to update the database, 59% to update logs.

- The O would use 32% of his activities to preapre documents, 10% to process documents, 2% to authorize documents, 6% to locate (archive) documents, 18% to update the database, 31% to update logs.

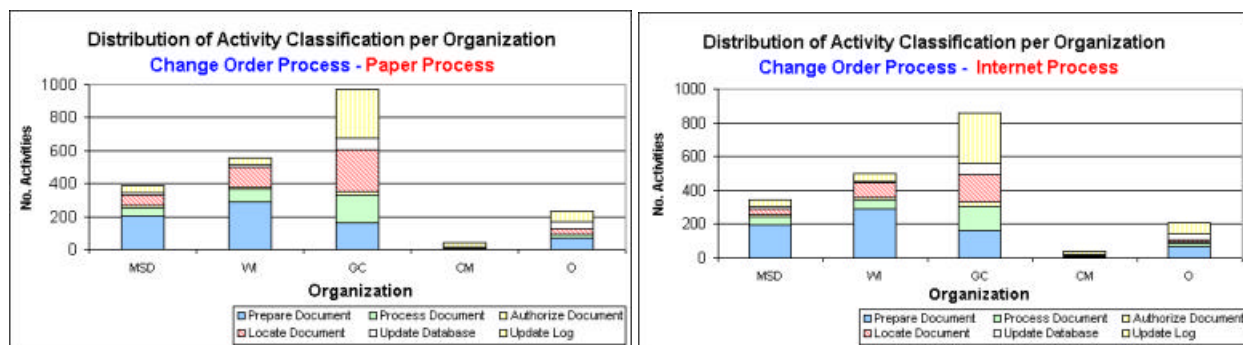Appendix C. Change Order Process Analysis and Results

Figure C-12-a, b. *Distribution of activities by activity classification per organization for the change order process for the paper-based system vs. an internet-based system.*

WI - PAPER	Activity Classification - Number of Activities						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	202	54	14	63	11	45	389
WI	292	77	14	117	11	45	556
GC	163	167	24	252	71	293	970
CM	4	11	2	0	0	24	41
O	68	23	4	33	38	66	232
TOTAL	729	332	58	465	131	473	2188

Table C-12-a. *Number of activities by activity classification per organization for the paper-based system.*

WI - PAPER	Activity Classification - Number of Activities (%)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	52%	14%	4%	16%	3%	12%	100%
WI	53%	14%	3%	21%	2%	8%	100%
GC	17%	17%	2%	26%	7%	30%	100%
CM	10%	27%	5%	0%	0%	59%	100%
O	29%	10%	2%	14%	16%	28%	100%

Table C-12-b. *Distribution of activities by activity classification per organization for the paper-based system.*

WI - INTERNET	Activity Classification - Number of Activities						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	199	44	14	33	11	45	346
WI	289	54	14	87	11	45	500
GC	161	145	24	162	71	293	856
CM	4	11	2	0	0	24	41
O	68	21	4	13	38	66	210
TOTAL	721	275	58	295	131	473	1953

Table C-12-c. *Number of activities by activity classification per organization for an internet-based system.*

WI - INTERNET	Activity Classification - Number of Activities (%)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	58%	13%	4%	10%	3%	13%	**100%**
WI	58%	11%	3%	17%	2%	9%	**100%**
GC	19%	17%	3%	19%	8%	34%	**100%**
CM	10%	27%	5%	0%	0%	59%	**100%**
O	32%	10%	2%	6%	18%	31%	**100%**

Table C-12-d. *Distribution of activities by activity classification per organization for an internet-based system.*

C.2.1.3.2. Distribution of Processing Effort of Activity Classification per Organization

How much processing effort was required per organization to prepare documents (e.g., create COR), to process documents (e.g., send COR), to authorize documents (e.g., review COR), to locate documents (e.g., retrieve an RFI), or to update the accounting database (e.g., enter cost code description) in the paper-based system vs. in an internet-based system?

How does the distribution of effort vary due to the internet-based system? (Ideally – the majority of the time should be on preparing documents).

Where does each organization feel the impact of the internet-based system most?

When the total processing effort is distributed by organization for each type of effect on activity, we observe the following:

Paper-based process

- The MSD sub spent 27% of his effort preparing documents, 8% processing documents, 52% authorizing documents, 7% locating (archiving) documents, 1% updating the accounting database, and 5% updating logs.

- The WI sub spent 31% of his effort preparing documents, 8% processing documents, 42% authorizing documents, 14% locating documents, 1% updating the accounting database, and 4% updating logs.

- The GC spent 10% of his effort preparing documents, 22% processing documents, 30% authorizing documents, 16% locating (archiving) documents, 6% updating the accounting database, and 17% updating the logs.

- The CM spent 4% of his effort preparing documents, 3% processing documents, 89% authorizing documents, 0% locating (archiving) documents, 0% updating the accounting database, and 4% updating the logs.

- The O spent 24% of his effort preparing documents, 23% processing documents, 3% authorizing documents, 11% locating (archiving) documents, 15% updating the accounting database, and 24% updating the logs.

Internet-based process

- The MSD sub would spend 22% of his effort preparing documents, 2% processing documents, 75% authorizing documents, 0% locating (archiving) documents, 0% updating the accounting database, and 0% updating logs.

- The WI sub would spend 22% of his effort preparing documents, 2% processing documents, 75% authorizing documents, 0% locating documents, 0% updating the accounting database, and 0% updating logs.

- The GC would spend 18% of his effort preparing documents, 10% processing documents, 50% authorizing documents, 18% locating (archiving) documents, 0% updating the accounting database, and 3% updating the logs.

- The CM would spend 9% of his effort preparing documents, 2% processing documents, 89% authorizing documents, 0% locating (archiving) documents, 0% updating the accounting database, and 0% updating the logs.

- The O would spend 45% of his effort preparing documents, 33% processing documents, 12% authorizing documents, 11% locating (archiving) documents, 0% updating the accounting database, and 0% updating the logs.

- The effort spent updating the accounting database and updating the logs would be automated and is assumed to be 0.
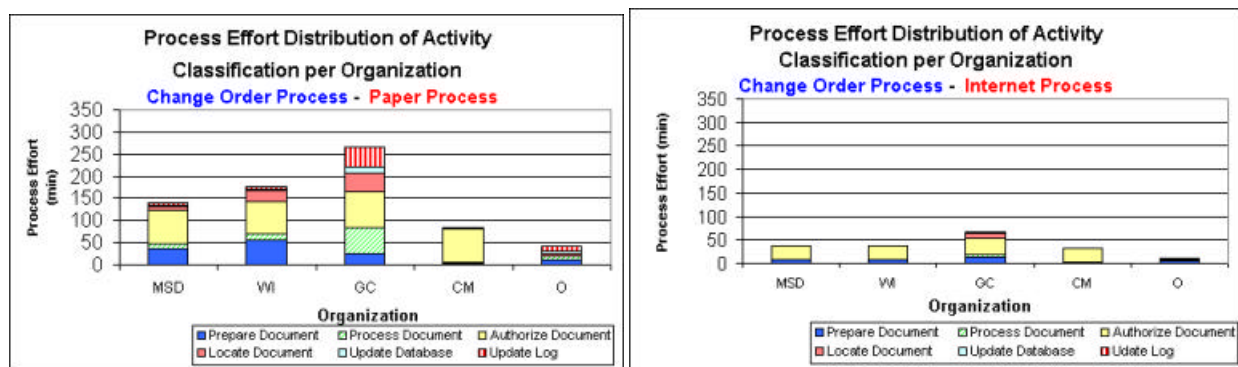
Figure C-12-c, d. *Distribution of processing effort by activity classification per organization for the change order process with the paper-based system vs. an internet-based system.*

WI - PAPER	Activity Classification - Processing Effort (min)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	38	11	74	11	1	6	140
WI	55	15	74	25	1	6	176
GC	26	59	79	42	15	45	267
CM	3	3	74	0	0	3	83
O	10	10	1	4	6	10	41
TOTAL	132	97	302	82	24	71	707

Table C-12-e. *Processing effort by activity classification per organization for the paper-based system.*

WI - PAPER	Activity Classification - Processing Effort (%)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	27%	8%	52%	7%	1%	5%	100%
WI	31%	8%	42%	14%	1%	4%	100%
GC	10%	22%	30%	16%	6%	17%	100%
CM	4%	3%	89%	0%	0%	4%	100%
O	24%	23%	3%	11%	15%	24%	100%

Table C-12-f. *Distribution of processing effort by activity classification per organization for the paper-based system.*

WI - INTERNET	Activity Classification - Processing Effort (min)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	8	1	28	0	0	0	38
WI	8	1	28	0	0	0	38
GC	12	7	34	12	0	2	67
CM	3	1	29	0	0	0	32
O	5	4	1	1	0	0	11
TOTAL	37	13	121	14	0	2	186

Table C-12-g. *Processing effort by activity classification per organization for an internet-based system.*

WI - INTERNET	Activity Classification - Processing Effort (%)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	22%	2%	75%	0%	0%	0%	100%
WI	22%	2%	75%	0%	0%	0%	100%
GC	18%	10%	50%	18%	0%	3%	100%
CM	9%	2%	89%	0%	0%	0%	100%
O	45%	33%	12%	11%	0%	0%	100%

Table C-12-h. *Distribution of processing effort by activity classification per organization for an internet-based system.*

WI	Activity Classification - Processing Effort (% Change)						
Organization	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
MSD	-78%	-93%	-62%	-98%	-100%	-100%	-73%
WI	-85%	-95%	-62%	-99%	-100%	-100%	-79%
GC	-54%	-89%	-57%	-70%	-100%	-96%	-75%
CM	-3%	-82%	-61%	-	-	-100%	-61%
O	-48%	-61%	-6%	-71%	-100%	-100%	-72%

Table C-12-i. *Percentage decrease in processing effort due to an internet-based system.*

C.2.2. Distribution per Activity Skill

The following sections discuss the distribution of activities and processing effort per activity skill in terms of the three other parameters: organization, effect on activity, and activity classification.

C.2.2.1. Distribution by Organization per Activity Skill

How does the number of activities by organization vary for each activity skill for the change order process with the paper-based system vs. with an internet-based system?

C.2.2.1.1. Distribution of Activities by Organization per Activity Skill

When the total number of activities is distributed by organization for each skill, we observe the following:

Paper-based process

- Of the managerial activities: The MSD sub performed 17%, The WI sub 18%, the GC 53%, the CM 3%, and the O 8%.

- Of the technical activities: The MSD sub performed 35%, The WI sub 50%, the GC 14%, the CM 0%, and the O 2%.

- Of the clerical activities: The MSD sub performed 17%, The WI sub 25%, the GC 45%, the CM 2%, and the O 11%.

Internet-based process

- Of the managerial activities: The MSD sub would perform 17%, The WI sub 18%, the GC 53%, the CM 3%, and the O 8%

- Of the technical activities: The MSD sub would perform 35%, The WI sub 50%, the GC 14%, the CM 0%, and the O 2%.

- Of the clerical activities: The MSD sub would perform 17%, The WI sub 25%, the GC 45%, the CM 2%, and the O 11%.
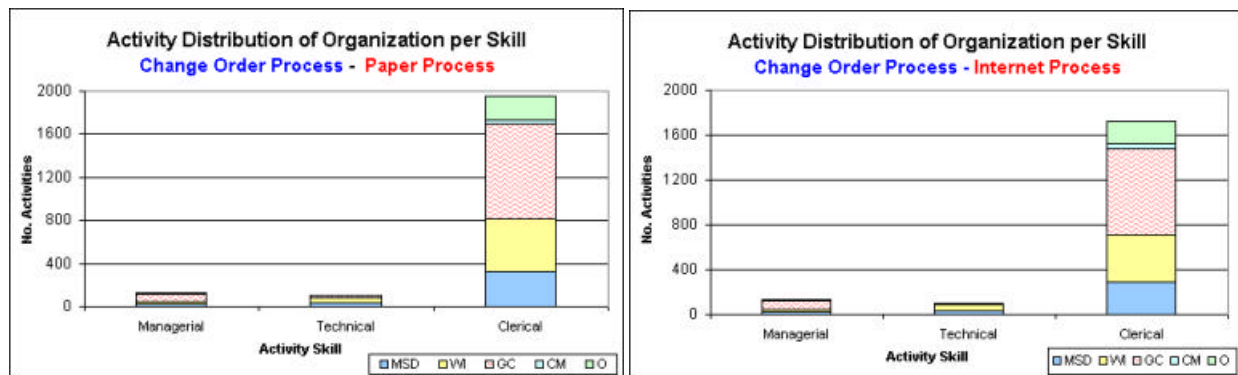
Figure C-13-a, b. *Distribution of activities by organization per activity skill for the change order process with the paper-based system vs. an internet-based system.*

WI	Organization - Number of Activities											
	Paper						Internet					
Skill	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Managerial	23	24	71	4	11	133	23	24	71	4	11	133
Technical	36	51	14	0	2	103	36	51	14	0	2	103
Clerical	330	481	885	37	219	1952	287	425	771	37	197	1717
TOTAL	389	556	970	41	232	2188	346	500	856	41	210	1953

Table C-13-a. *Number of activities by organization per activity skill for the paper-based system vs. an internet-based system.*

WI	Organization - Number of Activities (%)											
	Paper						Internet					
Skill	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Managerial	17%	18%	53%	3%	8%	100%	17%	18%	53%	3%	8%	100%
Technical	35%	50%	14%	0%	2%	100%	35%	50%	14%	0%	2%	100%
Clerical	17%	25%	45%	2%	11%	100%	17%	25%	45%	2%	11%	100%

Table C-13-b. *Distribution of activities by organization per activity skill for each type of system.*

C.2.2.1.2. Distribution of Processing Effort by Effect on Activity per Activity Skill

How does the processing effort by organization vary for each activity skill for the change order process with the paper-based system vs. with an internet-based system?

When the processing effort is distributed by organization for each skill, we observe the following:

Paper-based process

- For managerial activities: 24% of the effort was by the MSD sub, 24% by the WI sub, 29% by the GC, 22% by the CM, and 1% by the O.

- For technical activities: 100% of the effort was by the MSD sub.

- For clerical activities: 16% of the effort was by the MSD sub, 26% by the WI sub, 46% by the GC, 2% by the CM, and 10% by the O.

Internet-based process

- For managerial activities: 22% of the effort would be by the MSD sub, 22% by the WI sub, 33% by the GC, 20% by the CM, and 3% by the O.

- For technical activities: 100% of the effort would be automated.

- For clerical activities: 6% of the effort would be by the MSD sub, 5% by the WI sub, 58% by the GC, 3% by the CM, and 28% by the O.
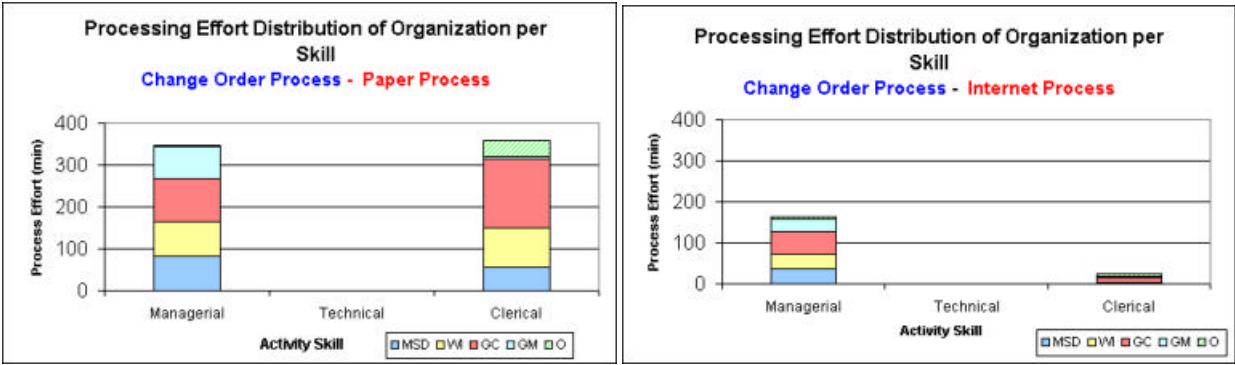

Figure C-13-c, d. *Distribution of processing effort by organization per activity skill for the change order process with the paper-based system vs. an internet-based system.*

WI	Organization - Processing Effort (min)											
	Paper						Internet					
Skill	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Managerial	83	83	101	77	5	348	36	36	54	32	5	163
Technical	1	0	0	0	0	1	0	0	0	0	0	0
Clerical	57	93	166	6	36	358	1	1	14	1	7	23
TOTAL	140	176	267	83	41	707	38	38	67	32	11	186

Table C-13-c. *Processing effort by organization per activity skill for the paper-based system vs. an internet-based system.*

WI	Organization											
	Paper						Internet					
Skill	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Managerial	24%	24%	29%	22%	1%	100%	22%	22%	33%	20%	3%	100%
Technical	100%	0%	0%	0%	0%	100%	-	-	-	-	-	-
Clerical	16%	26%	46%	2%	10%	100%	6%	5%	58%	3%	28%	100%

Table C-13-d. *Distribution of processing effort by organization per activity skill for each type of system.*

WI	Activity Classification - Processing Effort (% Change)					
Organization	MSD	WI	GC	CM	O	TOTAL
Managerial	-56%	-56%	-47%	-59%	-2%	**-53%**
Technical	-100%	0%	0%	0%	0%	**-100%**
Clerical	-97%	-99%	-92%	-89%	-82%	**-93%**

Table C-13-e. *Percentage decrease in processing effort due to an internet-based system.*

C.2.2.2. Distribution by Effect on Activity per Activity Skill

C.2.2.2.1. Distribution of Activities by Effect on Activity per Activity Skill

An internet-based system would affect activities in terms of processing effort. For each organization, how many activities would remain the same? How many activities would be reduced? How many activities would be automated? How many activities would be eliminated?

When the total number of activities is distributed by effect on activity for each skill, we observe the following:

From the paper-based process to the internet-based process

- Of the managerial activities: 83% would remain the same, 13% would be reduced and 5% would be automated.

- Of the technical activities: 100% would be automated.

- Of the clerical activities: only 3% would remain the same, 2% would be reduced, 83% would be automated, and 12% would be eliminated.
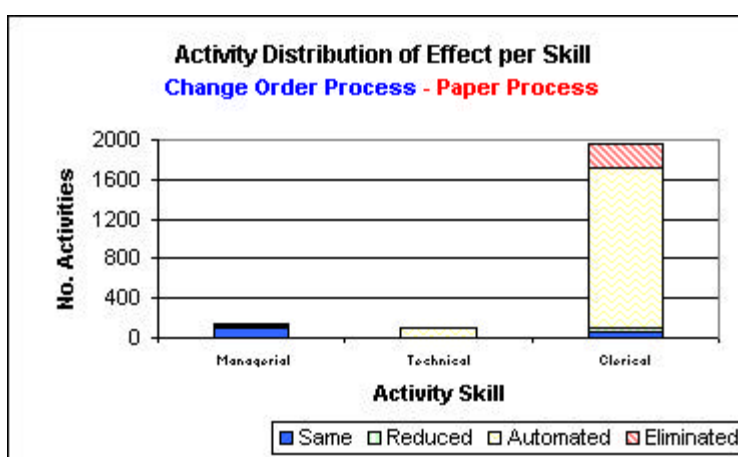

Figure C-14-a. *Distribution of activities by effect on activity per activity skill for the change order process due to the paper-based system vs. an internet-based system.*

WI	Effect - Number of Activities				
Activity Skill	Same	Reduced	Automated	Eliminated	TOTAL
Managerial	110	17	6	0	133
Technical	0	0	103	0	103
Clerical	51	43	1623	235	1952
TOTAL	161	60	1732	235	2188

Table C-14-a. *Number of activities by effect on activity per activity skill.*

WI	Effect - Number of Activities (%)				
Activity Skill	Same	Reduced	Automated	Eliminated	TOTAL
Managerial	83%	13%	5%	0%	100%
Technical	0%	0%	100%	0%	100%
Clerical	3%	2%	83%	12%	100%

Table C-14-b. *Distribution of activities by effect on activity per activity skill.*

C.2.2.2.2. Distribution of Processing Effort by Effect on Activity per Activity Skill

An internet-based system would affect activities in terms of processing effort. For each activity skill, how many activities would remain the same? How many would be reduced? How many would be automated? How many would be eliminated?

When the total processing effort is distributed by effect on activity for each skill, we observe the following:

From the paper-based process to the internet-based process

- Of the effort for managerial activities: 28% would remain the same, and 72% would be reduced.

- Of the effort for technical activities: 100% would be automated.

- Of the effort for clerical activities: only 5% would remain the same, 8% would be reduced, 73% would be automated, and 14% would be eliminated.
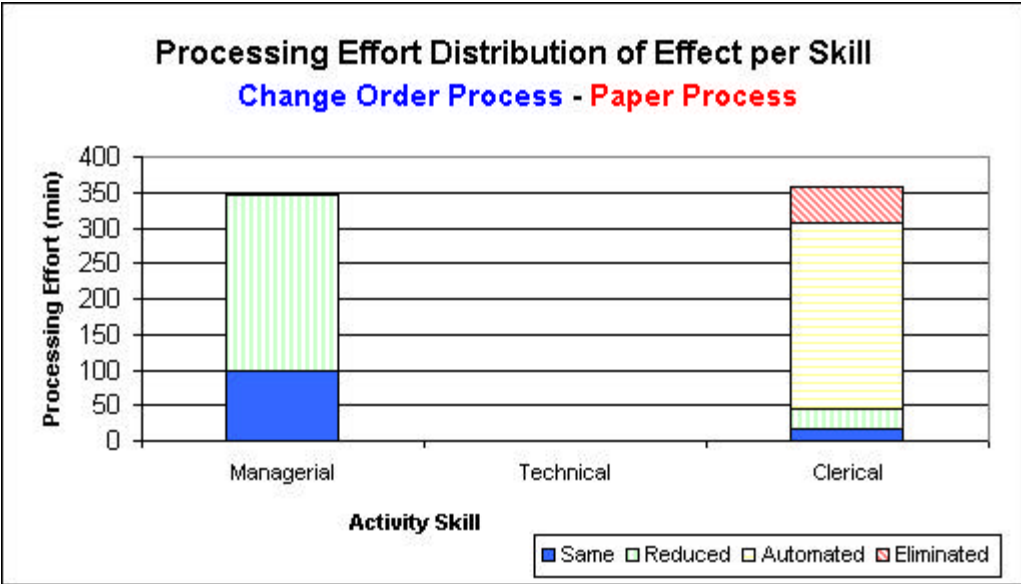

Figure C-14-b. *Distribution of processing effort by effect on activity per activity skill for the change order process due to the paper-based system vs. an internet-based system.*

WI	Effect - Processing Effort (min)				
Activity Skill	Same	Reduced	Automated	Eliminated	TOTAL
Managerial	98	250	1	0	348
Technical	0	0	1	0	1
Clerical	17	29	261	52	358
TOTAL	115	278	262	52	707

Table C-14-c. *Processing effort by effect on activity per activity skill.*

WI	Effect - Processing Effort (%)				
Activity Skill	Same	Reduced	Automated	Eliminated	TOTAL
Managerial	28%	72%	0%	0%	100%
Technical	0%	0%	100%	0%	100%
Clerical	5%	8%	73%	14%	100%

Table C-14-d. *Distribution of processing effort by effect on activity per activity skill.*

C.2.2.3. Distribution by Activity Classification per Activity Skill

C.2.2.3.1. Distribution of Activities by Activity Classification per Activity Skill

How does the number of activities by activity classification (prepare document, process document, authorize document, locate document, update the accounting database, or update the logs) vary for each activity skill for the change order process with the paper-based system vs. with an internet-based system?

When the total number of activities is distributed by activity classification for each skill, we observe the following:

Paper-based process

- Of the managerial activities: 28% were to prepare documents, 10% to process documents, 39% to authorize documents, 22% to locate documents, and 2% to update logs.

- Of the technical activities: 96% were to prepare documents, 2% to update the accounting database, and 2% to update logs.

- Of the clerical activities: 30% were to prepare documents, 16% to process documents, 22% to locate documents, 7% to update the accounting database, and 24% to update logs.

Internet-based process

- Of the managerial activities: 28% would be to prepare documents, 10% to process documents, 39% to authorize documents, 22% to locate documents, and 2% to update logs.

- Of the technical activities: 96% would be to prepare documents, 2% to update the accounting database, and 2% to update logs.

- Of the clerical activities: 34% would be to prepare the documents, 15% to process documents, 15% to locate documents, 8% to update the accounting database, and 27% update logs.
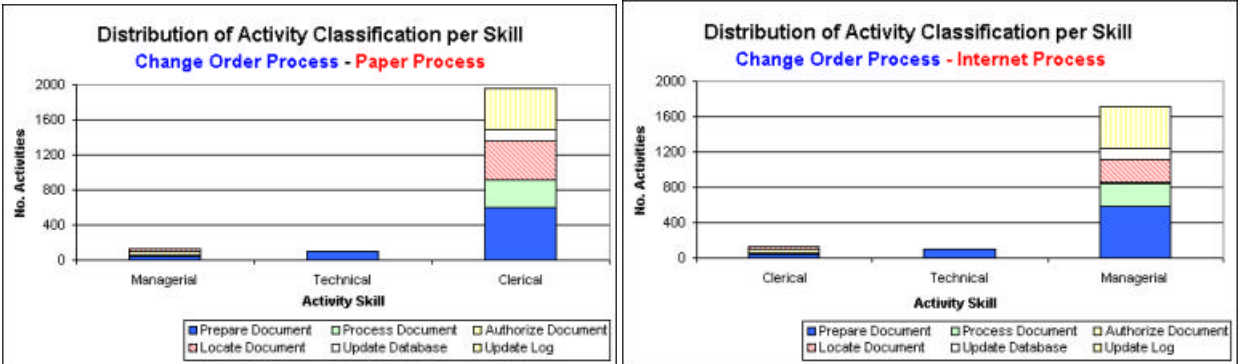

Figure C-15-a, b. *Distribution of activities by activity classification per activity skill for the change order process with the paper-based system vs. an internet-based system.*

WI - PAPER	Activity Classification - Number of Activities						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	37	13	52	29	0	2	133
Technical	99	0	0	0	2	2	103
Clerical	593	319	6	436	129	469	1952
TOTAL	729	332	58	465	131	473	2188

Table C-15-a. *Number of activities by activity classification per activity skill for the paper-based system.*

WI - PAPER	Activity Classification - Number of Activities						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	28%	10%	39%	22%	0%	2%	100%
Technical	96%	0%	0%	0%	2%	2%	100%
Clerical	30%	16%	0%	22%	7%	24%	100%

Table C-15-b. *Distribution of activities by activity classification per activity skill for the paper-based system.*

WI - INTERNET	Activity Classification - Number of Activities						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	37	13	52	29	0	2	133
Technical	99	0	0	0	2	2	103
Clerical	585	262	6	266	129	469	1717
TOTAL	721	275	58	295	131	473	1953

Table C-15-c. *Number of activities by activity classification per activity skill for an internet-based system.*

WI - INTERNET	Activity Classification - Number of Activities						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	28%	10%	39%	22%	0%	2%	100%
Technical	96%	0%	0%	0%	2%	2%	100%
Clerical	34%	15%	0%	15%	8%	27%	100%

Table C-15-d. *Distribution of activities by activity classification per activity skill for an internet-based system.*

C.2.2.3.2. Distribution of Processing Effort by Activity Classification per Activity Skill

How does the processing effort by activity classification (prepare document, process document, authorize document, locate document, update the accounting database, or update logs) vary for each activity skill for the change order process with the paper-based system vs. with an internet-based system?

When the processing effort is distributed by activity classification for each skill, we observe the following:

Paper-based process

- Of the effort spent on managerial activities: 10% was to prepare documents, 1% to process documents, 87% to authorize documents, 2% to locate documents and 1% to update logs.

- Of the effort spent on technical activities: 100% was to prepare documents.

- Of the effort spent on clerical activities: 27% was to prepare documents, 26% to process documents, 21% to locate documents, 7% to update the accounting database, and 19% to update logs.

Internet-based process

- Of the effort spent on managerial activities: 18% would be to prepare documents, 3% to process the document, 74% to authorize documents, 4% to locate documents and 1% to update the log.

- Of the effort spent on technical activities: 100% would be automated.

- Of the effort spent on clerical activities: 35% would be to prepare documents, 36% to locate the documents and 29% to process documents.
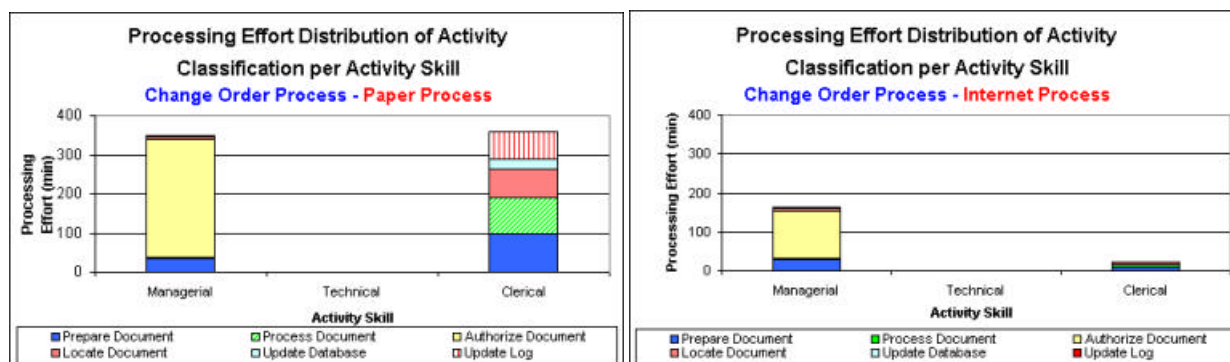

Figure C-15-c, d. *Distribution of processing effort by activity classification per activity skill for the change order process with the paper-based system vs. an internet-based system.*

WI - PAPER	Activity Classification - Processing Effort (min)						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	34	4	301	7	0	2	348
Technical	1	0	0	0	0	0	1
Clerical	97	93	1	74	24	69	358
TOTAL	132	97	302	82	24	71	707

Table C-15-e. *Processing effort by activity classification per activity skill for the paper-based system.*

WI - PAPER	Activity Classification - Processing Effort (%)						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	10%	1%	87%	2%	0%	1%	100%
Technical	100%	0%	0%	0%	0%	0%	100%
Clerical	27%	26%	0%	21%	7%	19%	100%

Table C-15-f. *Distribution of processing effort by activity classification per activity skill for the paper-based system.*

WI - INTERNET	Activity Classification - Processing Effort (min)						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	29	4	121	7	0	2	163
Technical	0	0	0	0	0	0	0
Clerical	8	8	0	7	0	0	23
TOTAL	37	13	121	14	0	2	186

Table C-15-g. *Processing effort by activity classification per activity skill for an internet-based system.*

WI - INTERNET	Activity Classification - Processing Effort (%)						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	18%	3%	74%	4%	0%	1%	100%
Technical	-	-	-	-	-	-	-
Clerical	35%	36%	0%	29%	0%	0%	100%

Table C-15-h. *Distribution of processing effort by activity classification per activity skill for an internet-based system.*

WI	Activity Classification - Processing Effort (% Change)						
Activity Skill	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Managerial	10%	0%	1%	0%		0%	4%
Technical	100%						100%
Clerical	96%	89%	100%	91%	100%	100%	94%

Table C-15-i. *Percentage decrease in processing effort due to internet-based system.*

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C.2.3. Distribution per Effect of Integration on Activity

The following sections discuss the distribution of activities and processing effort per effect on activity in terms of the three other parameters: organization, activity skill, and activity classification.

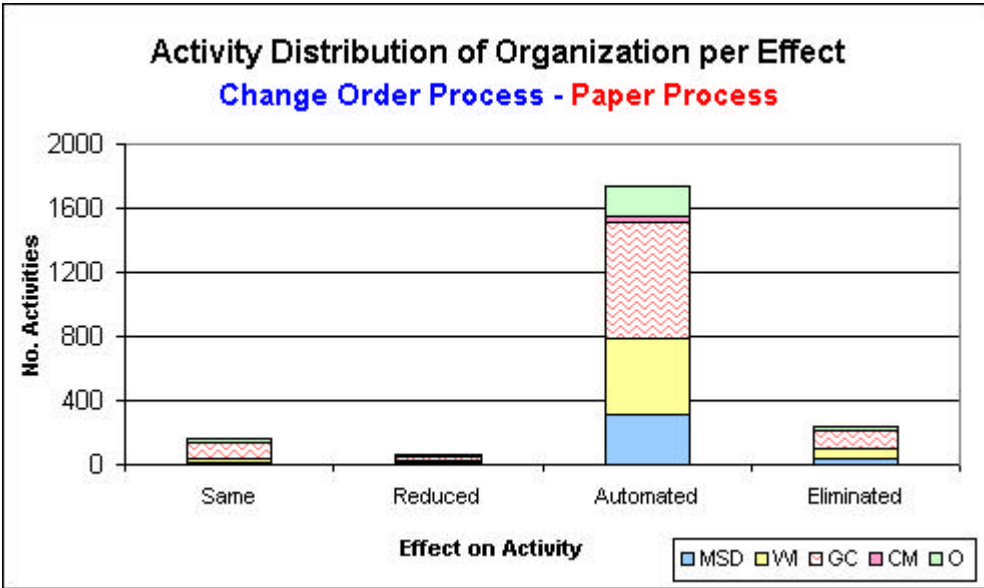C.2.3.1. Distribution by Organization per Effect on Activity

C.2.3.1.1. Distribution of Activities by Organization per Effect on Activity

How would the number of activities be distributed by organization for each effect on activity for the change order process going from the paper-based system to an internet-based system?

When the total number of activities is distributed by organization for each effect on activity, we observe the following:

From the paper-based process to the internet-based process

- Of the activities that would remain the same: The MSD sub would perform 11%, the WI sub 11%, the GC 61%, the CM 3%, and the O 13%.

- Of the activities that an internet-based system would reduce in processing effort: The MSD sub would perform 20%, the WI sub 20%, the GC 53% the CM 2%, and the O 5%.

- Of the activities that an internet-based system would automate: The MSD sub would perform 18%, the WI sub 27%, the GC 42%, the CM 2%, and the O 11%.

- Of the activities that an internet-based system would eliminate: The MSD sub would perform 18%, the WI sub 24%, the GC 49%, the CM 0%, and the O 9%.

Figure C-16-a. *Distribution of activities by organization per effect on activity for the change order process due to the paper-based system vs. an internet-based system.*

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WI	Organization - Number of Activities					
Effect on Activity	MSD	WI	GC	CM	O	TOTAL
Same	18	18	99	5	21	161
Reduced	12	12	32	1	3	60
Automated	316	470	725	35	186	1732
Eliminated	43	56	114	0	22	235
TOTAL	389	556	970	41	232	2188

Table C-16-a. *Number of activities by organization per effect on activity.*

WI	Organization - Relative % of Total Number of activities					
Effect on Activity	MSD	WI	GC	CM	O	TOTAL
Same	11%	11%	61%	3%	13%	100%
Reduced	20%	20%	53%	2%	5%	100%
Automated	18%	27%	42%	2%	11%	100%
Eliminated	18%	24%	49%	0%	9%	100%

Table C-16-b. *Distribution of activities by organization per effect on activity.*

C.2.3.1.2. Distribution of Processing Effort by Organization per Effect on Activity

How would the processing effort be distributed by organization for each effect on activity for the change order process going from the paper-based system to an internet-based system?

When the total processing effort is distributed by organization for each effect on activity, we observe the following:

From the paper-based process to the internet-based process

- Of the processing effort for activities that would remain the same: 19% would be for the MSD sub, 20% for the WI sub, 39% for the GC, 16% for the CM, and 6% for the O.

- Of the processing effort for activities that an internet-based system would reduce: 11% would be for the MSD sub, 11% for the WI sub, 74% for the GC, 0% for the CM, 5% for the O.

- Of the processing effort for activities that an internet-based system would automate: 21% would be due to the MSD sub, 34% to the WI sub, 34% to the GC, 2% to the CM, and 9% to the O.

- Of the processing effort for activities that an internet-based system would eliminate: 15% would be due to the MSD sub, 20% to the WI sub, 57% to the GC, 1% to the CM, and 8% to the O.
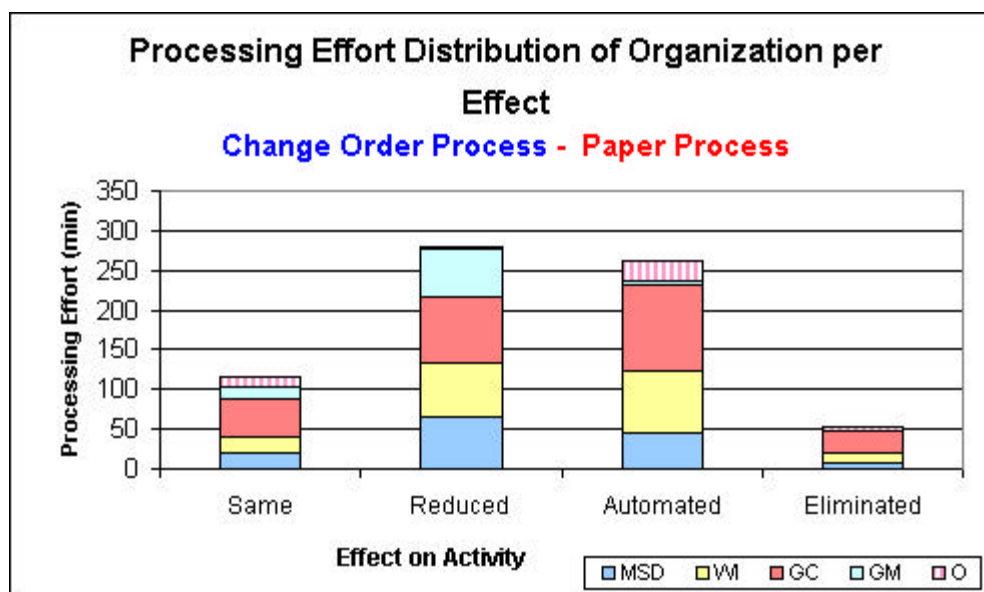

Figure C-16-b. *Distribution of processing effort by organization per effect on activity for the change order process due to the paper-based system vs. an internet-based system.*

WI	Organization - Processing Effort (min)					
Effect on Activity	MSD	WI	GC	CM	O	TOTAL
Same	20	20	47	17	11	115
Reduced	67	67	83	60	2	278
Automated	46	78	108	6	25	262
Eliminated	8	11	29	0	4	52
TOTAL	140	176	267	83	41	707

Table C-16-c. *Processing effort by organization per effect on activity.*

WI	Organization - Processing Effort (%)					
Effect on Activity	MSD	WI	GC	CM	O	TOTAL
Same	18%	17%	41%	15%	9%	100%
Reduced	24%	24%	30%	22%	1%	100%
Automated	17%	30%	41%	2%	9%	100%
Eliminated	15%	22%	56%	0%	7%	100%

Table C-16-d. *Distribution of processing effort by organization per effect on activity.*

C.2.3.2. Distribution by Activity Skill per Effect on Activity

C.2.3.2.1. Distribution of Activities by Activity Skill per Effect on Activity

How would the number of activities be distributed by activity skill (managerial, technical, or clerical) for each effect on activity for the change order process going from the paper-based system to an internet-based system?

When the total number of activities is distributed by activity skill for each effect on activity, we observe the following:

From the paper-based process to the internet-based process

- Of the activities that would remain the same: 68% would be managerial activities and only 32% clerical activities.

- Of the activities that an internet-based system would reduce in processing effort: 28% would be managerial activities and 72% would be clerical activities.

- Of the activities that an internet-based system would automate: 6% would be technical activities, and 94% would be clerical activities.

- Of the activities that an internet-based system would eliminate: 100% would be clerical activities.
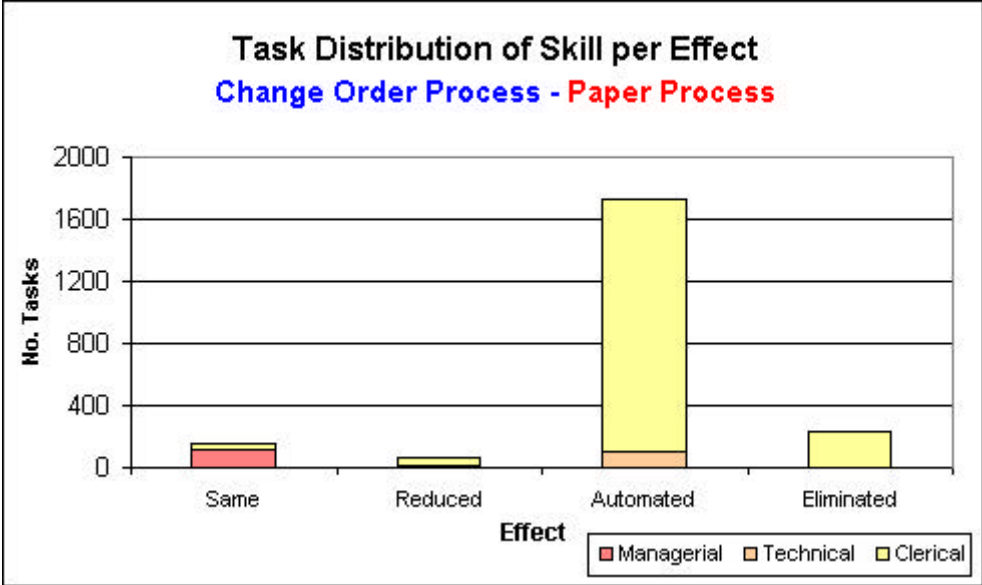

Figure C-17-a. *Distribution of activities by activity skill per effect on activity for the change order process from the paper-based system to an internet-based system.*

WI	Activity Skill - Number of Activities			
Effect on Activity	Managerial	Technical	Clerical	TOTAL
Same	110	0	51	161
Reduced	17	0	43	60
Automated	6	103	1623	1732
Eliminated	0	0	235	235
TOTAL	133	103	1952	2188

Table C-17-a. *Number of activities by activity skill per effect on activity.*

WI	Activity Skill - Number of activities (%)			
Effect on Activity	Managerial	Technical	Clerical	TOTAL
Same	68%	0%	32%	100%
Reduced	28%	0%	72%	100%
Automated	0%	6%	94%	100%
Eliminated	0%	0%	100%	100%

Table C-17-b. *Distribution of activities by activity skill per effect on activity.*

How would the processing effort be distributed by activity skill (managerial, technical, or clerical) for each effect on activity for the change order process going from the paper-based system to an internet-based system?

When the total processing effort is distributed by activity skill for each effect on activity, we observe the following:

From the paper-based process to the internet-based process

- Of the processing effort for activities that would remain the same: 85% would be for managerial activities and 15% for clerical activities.

- Of the processing effort for activities that an internet-based system would reduce: 90% would be for managerial activities and 10% would be for clerical activities.

- Of the processing effort for activities that an internet-based system would automate: 100% would be for clerical activities.

- Of the processing effort for activities that an internet-based system would eliminate: 100% would be for clerical activities.
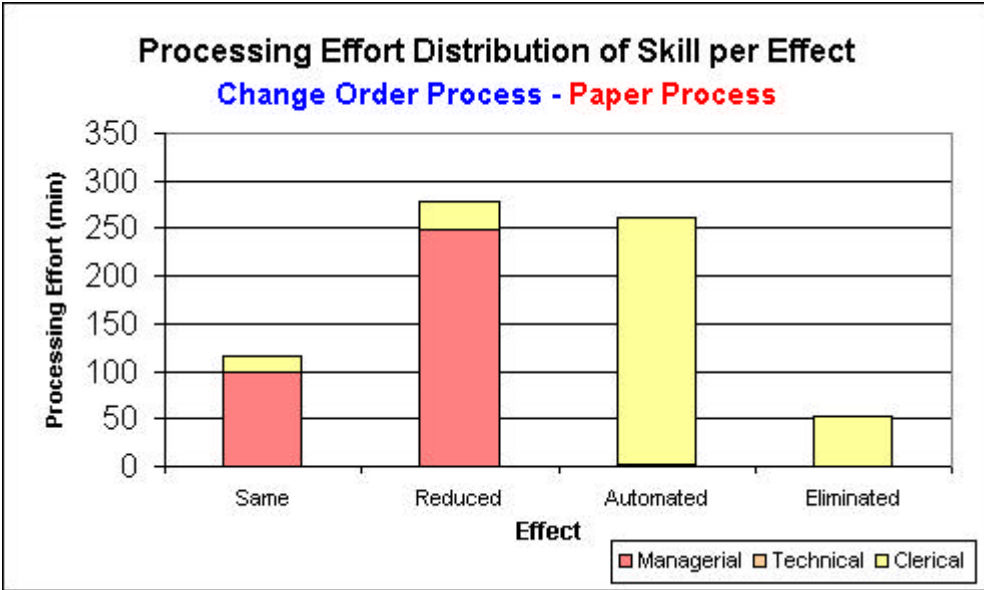

Figure C-17-b. *Distribution of processing effort by activity skill per effect on activity for the change order process due to the paper-based system vs. an internet-based system.*

WI	Activity Skill - Processing Effort (min)			
Effect on Activity	Managerial	Technical	Clerical	TOTAL
Same	98	0	17	115
Reduced	250	0	29	278
Automated	1	1	261	262
Eliminated	0	0	52	52
TOTAL	348	1	358	707

Table C-17-c. *Processing effort by activity skill per effect on activity.*

WI	Activity Skill - Processing Effort (%)			
Effect on Activity	Managerial	Technical	Clerical	TOTAL
Same	85%	0%	15%	100%
Reduced	90%	0%	10%	100%
Automated	0%	0%	100%	100%
Eliminated	0%	0%	100%	100%

Table C-17-d. *Distribution of processing effort by activity skill per effect on activity.*

C.2.3.3. Distribution by Activity Classification per Effect on Activity

C.2.3.3.1. Distribution of Activities by Activity Classification per Effect on Activity

    What would be the distribution in the number of activities by activity classification (prepare document, process document, authorize document, locate document, or update database) for each effect on activity for the change order process going from the paper-based system to an internet-based system?

    When the total number of activities is distributed by activity classification for each effect on activity, we observe the following:

From the paper-based process to the internet-based process

- Of the activities that would remain the same: 31% would be to prepare documents, 11% to process the documents, 26% to authorize documents, 31% to locate documents and 1% to update logs.

- Of the activities that an internet-based system would reduce in processing effort: 42% would be to process documents, 48% to process documents, 7% to authorize documents and 3% to locate documents.

- Of the activities that an internet-based system would automate: 37% would be to prepare documents, 13% to process documents, 1% to authorize documents, 14% to locate documents, 8% to update the accounting database, and 27% to update logs.

- Of the activities that an internet-based system would eliminate: 3% would be to prepare documents, 24% would be to process documents, and 72% would be to locate (archive) documents.
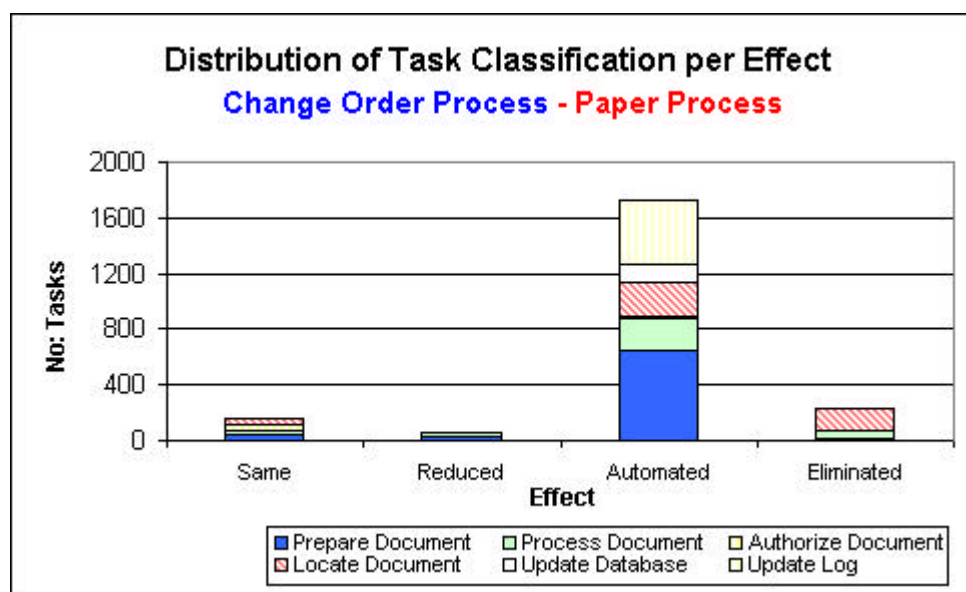

Figure C-18-a. *Distribution of activities by activity classification per effect on activity for the change order process from the paper-based system to an internet-based system.*

WI	Activity Classification - Number of Activities						
Effect on Activity	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Same	50	17	42	50	0	2	161
Reduced	25	29	4	2	0	0	60
Automated	646	229	12	243	131	471	1732
Eliminated	8	57	0	170	0	0	235
TOTAL	729	332	58	465	131	473	2188

Table C-18-a. *Number of activities by activity classification per effect on activity.*

Appendix C. Change Order Process Analysis and Results

WI	Activity Classification - Number of Activities (%)						
Effect on Activity	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Same	31%	11%	26%	31%	0%	1%	100%
Reduced	42%	48%	7%	3%	0%	0%	100%
Automated	37%	13%	1%	14%	8%	27%	100%
Eliminated	3%	24%	0%	72%	0%	0%	100%

Table C-18-b. *Distribution of activities by activity classification per effect on activity.*

C.2.3.3.2. Distribution of Processing Effort by Activity Classification per Effect on Activity

What would be the distribution in the processing effort by activity classification (prepare document, process document, authorize document, locate document, or update database) for each effect on activity for the change order process going from the paper-based system to an internet-based system?

When the total processing effort is distributed by activity classification for each effect on activity, we observe the following:

From the paper-based process to the internet-based process

- Of the processing effort for activities that would remain the same: 27% would be to prepare documents, 7% to process documents, 53% to authorize documents, 12% to locate documents and 2% to update logs.

- Of the processing effort for activities that an internet-based system would reduce: 4% would be to prepare the documents, 9% to process documents, and 86% to authorize documents.

- Of the activities that an internet-based system would automate: 32% would be to prepare documents, 12% to process documents, 19% to locate documents, 9% to update the accounting database, and 26% to update logs.

- Of the activities that an internet-based system would eliminate: 8% would be to prepare documents 59% to process documents, and 33% to locate (archive) documents.
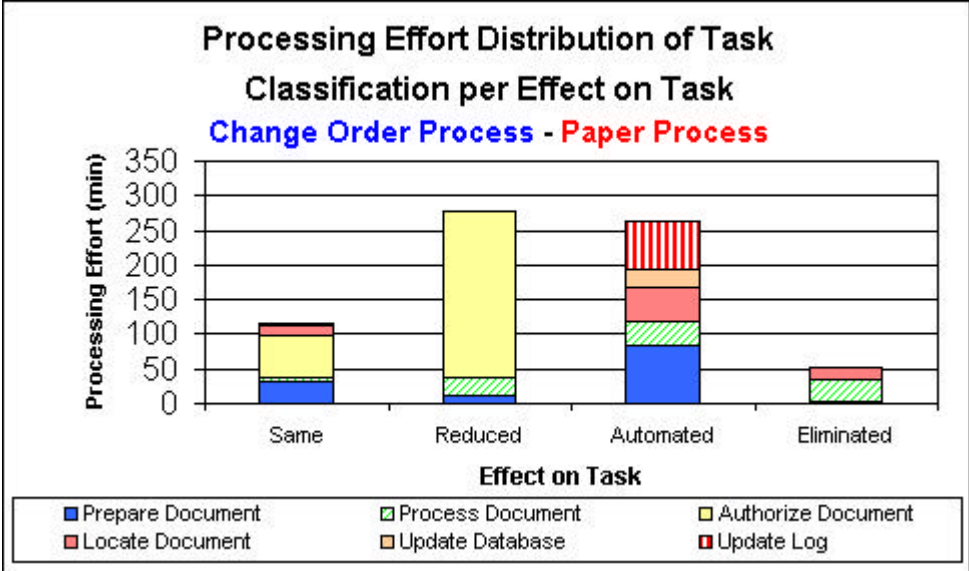

Figure C-18-b. *Distribution of processing effort by activity classification per effect on activity for the change order process with the paper-based system vs. an internet-based system.*

WI	Activity Classification - Processing Effort (min)						
Effect on Activity	**Prepare Document**	**Process Document**	**Authorize Document**	**Locate Document**	**Update Database**	**Update Log**	**TOTAL**
Same	31	8	61	14	0	2	**115**
Reduced	12	26	240	0	0	0	**278**
Automated	85	33	1	50	24	69	**262**
Eliminated	4	31	0	17	0	0	**52**
TOTAL	**132**	**97**	**302**	**82**	**24**	**71**	**707**

Table C-18-c. *Processing effort by activity classification per effect on activity.*

Appendix C. Change Order Process Analysis and Results

WI	Activity Classification - Processing Effort (%)						
Effect on Activity	Prepare Document	Process Document	Authorize Document	Locate Document	Update Database	Update Log	TOTAL
Same	27%	7%	53%	12%	0%	2%	100%
Reduced	4%	9%	86%	0%	0%	0%	100%
Automated	32%	12%	0%	19%	9%	26%	100%
Eliminated	8%	59%	0%	33%	0%	0%	100%

Table C-18-d. *Distribution of processing effort by activity classification per effect on activity.*

C.2.4. Distribution per Activity Classification

The following sections discuss the distribution of activities and processing effort per effect on activity in terms of the three other parameters: organization, activity skill, and effect on activity.

C.2.4.1. Distribution by Organization per Activity Classification

C.2.4.1.1. Distribution of Activities by Organization per Activity Classification

How does the number of activities by organization (MSD, WI, GC, CM or O) vary for each activity classification for the change order process with the paper-based system vs. with an internet-based system?

When the total number of activities is distributed by organization for each type of activity classification, we observe the following:

Paper-based process

- 729 activities were used to prepare documents: 28% were performed by the MSD, 40% by the WI, 22% by the GC, 1% by the CM and 9% by the O.

- 332 activities were used to process documents: 16% were performed by the MSD, 23% by the WI, 50% by the GC, 3% by the CM, and 7% by the O.

- 58 activities were used to authorize documents: 24% were performed by the MSD, 24% by the WI, 41% by the GC, 3% by the CM and 7% by the O.

- 465 activities were used to locate documents: 14% were performed by the MSD, 25% by the WI, 54% by the GC, and 7% by the O.

- 131 activities were used to update the accounting databases: 8% were performed by the MSD, 8% by the WI, 54% by the GC, and 29% by the O.

- 473 activities were used to update logs: 10% were performed by the MSD, 10% by the WI, 62% by the GC, 5% by the CM, and 14% by the O.

Internet-based process

- 721 activities would be used to prepare documents: 28% would be performed by the MSD, 40% by the WI, 22% by the GC, 1% by the CM and 9% by the O.

- 275 activities would be used to process documents: 16% would be performed by the MSD, 20% by the WI, 53% by the GC, 4% by the CM, and 8% by the O.

- 58 activities would be used to authorize documents: 24% would be performed by the MSD, 24% by the WI, 41% by the GC, 3% by the CM and 7% by the O.

- 295 activities would be used to locate documents: 11% would be performed by the MSD, 29% by the WI, 55% by the GC, and 4% by the O.

- 131 activities would be used to update the accounting databases: 8% would be performed by the MSD, 8% by the WI, 54% by the GC, and 29% by the O.

- 473 activities would be used to update logs: 10% would be performed by the MSD, 10% by the WI, 62% by the GC, 5% by the CM, and 14% by the O.
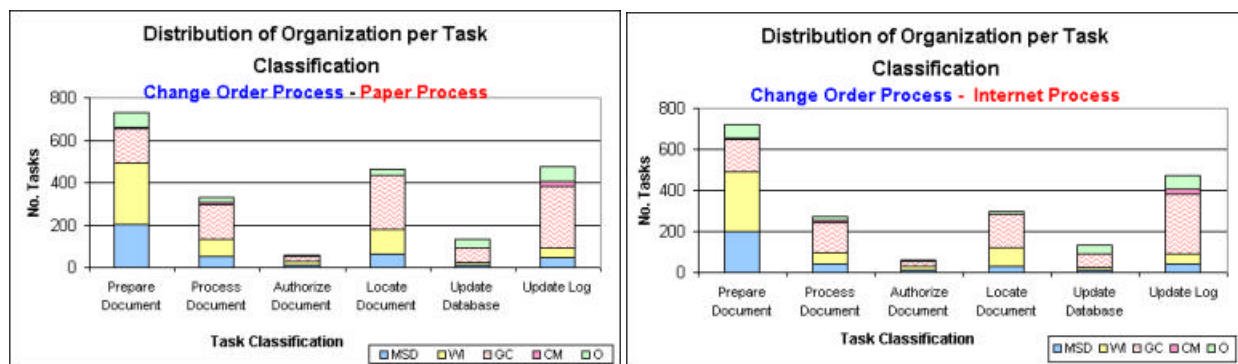
Figure C-19-a, b. *Distribution of activities by organization per activity classification for the change order process with the paper-based system vs. an internet-based system.*

WI	Organization - Number of Activities											
	Paper						Internet					
Activity Classification	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Prepare Document	202	292	163	4	68	**729**	199	289	161	4	68	**721**
Process Document	54	77	167	11	23	**332**	44	54	145	11	21	**275**
Authorize Document	14	14	24	2	4	**58**	14	14	24	2	4	**58**
Locate Document	63	117	252	0	33	**465**	33	87	162	0	13	**295**
Update Database	11	11	71	0	38	**131**	11	11	71	0	38	**131**
Update Log	45	45	293	24	66	**473**	45	45	293	24	66	**473**
TOTAL	389	556	970	41	232	2188	346	500	856	41	210	1953

Table C-19-a. *Number of activities by organization per activity classification for the paper-based system vs. an internet-based system.*

WI	Organization - Number of Activities											
	Paper						Internet					
Activity Classification	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Prepare Document	28%	40%	22%	1%	9%	**100%**	28%	40%	22%	1%	9%	**100%**
Process Document	16%	23%	50%	3%	7%	**100%**	16%	20%	53%	4%	8%	**100%**
Authorize Document	24%	24%	41%	3%	7%	**100%**	24%	24%	41%	3%	7%	**100%**
Locate Document	14%	25%	54%	0%	7%	**100%**	11%	29%	55%	0%	4%	**100%**
Update Database	8%	8%	54%	0%	29%	**100%**	8%	8%	54%	0%	29%	**100%**
Update Log	10%	10%	62%	5%	14%	**100%**	10%	10%	62%	5%	14%	**100%**

Table C-19-b. *Distribution of activities by organization per activity classification for each type of system.*

C.2.4.1.2. Distribution of Processing Effort by Organization per Activity Classification

How does the processing effort by organization (MSD, WI, GC, CM ,or O) vary for each activity classification for the change order process with the paper-based system vs. with an internet-based system?

When the processing effort is distributed by organization for each type of activity classification, we observe the following:

Paper-based process

- The processing effort to prepare documents was 132 minutes: 29% was consumed by MSD, 42% by WI, 20% by GC, 2% by CM, and 7% by O.

- The processing effort to process documents was 97 minutes: 11% was consumed by MSD, 15% by WI, 61% by GC, 3% by CM, and 10% by O.

- The processing effort to authorize documents was 302 minutes: 24% was consumed by MSD, 24% by WI, 26% by GC, and 25% by CM.

- The processing effort to locate documents was 82 minutes: 13% was consumed by MSD, 31% by WI, 51% by GC, and 5% by O.

- The processing effort to update the accounting database was 24 minutes: 6% was consumed by MSD, 6% by WI, 63% by GC, and 26% by O.

- The processing effort to update the log was 71 minutes: 9% was consumed by MSD, 9% by WI, 64% by GC, 4% by CM, and 14% by O.

Internet-based process

- The processing effort to prepare documents would be 37 minutes: 23% would be consumed by MSD, 23% by WI, 33% by GC, 8% by CM, and 14% by O.

- The processing effort to process documents would be 13 minutes: 6% would be consumed by MSD, 6% by WI, 54% by GC, 4% by CM, and 30% by O.

- The processing effort to authorize documents would be 121 minutes: 23% would be consumed by MSD, 23% by WI, 28% by GC, 24% by CM, and 1% by O.

- The processing effort to locate documents would be 14 minutes: 1% would be consumed by MSD, 1% by WI, 89% by GC, and 9% by O.

- The processing effort to update the accounting database would be 0 minutes: All activities would be automated.

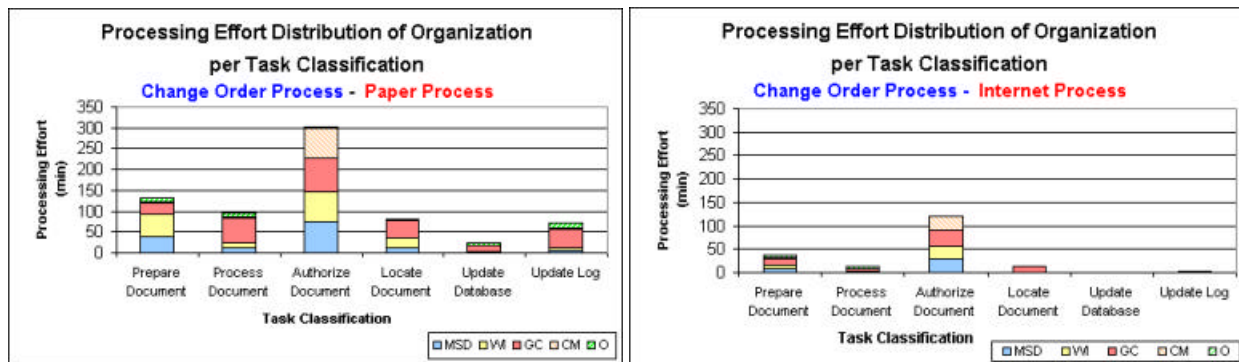- The processing effort to update logs would be 2 minutes: 100%% would be consumed by GC.

Figure C-19-c, d. *Distribution of processing effort by organization per activity classification for the change order process with the paper-based system vs. an internet-based system.*

WI	Organization - Processing Effort (min)											
	Paper						Internet					
Activity Classification	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Prepare Document	38	55	26	3	10	132	8	8	12	3	5	37
Process Document	11	15	59	3	10	97	1	1	7	1	4	13
Authorize Document	74	74	79	74	1	302	28	28	34	29	1	121
Locate Document	11	25	42	0	4	82	0	0	12	0	1	14
Update Database	1	1	15	0	6	24	0	0	0	0	0	0
Update Log	6	6	45	3	10	71	0	0	2	0	0	2
TOTAL	140	176	267	83	41	707	38	38	67	32	11	186

Table C-19-c. *Processing effort by organization per activity classification for the paper-based system vs. an internet-based system.*

WI	Organization - Processing Effort (%)											
	Paper						Internet					
Activity Classification	MSD	WI	GC	CM	O	TOTAL	MSD	WI	GC	CM	O	TOTAL
Prepare Document	29%	42%	20%	2%	7%	100%	23%	23%	33%	8%	14%	100%
Process Document	11%	15%	61%	3%	10%	100%	6%	6%	54%	4%	30%	100%
Authorize Document	24%	24%	26%	25%	0%	100%	23%	23%	28%	24%	1%	100%
Locate Document	13%	31%	51%	0%	5%	100%	1%	1%	89%	0%	9%	100%
Update Database	6%	6%	63%	0%	26%	100%						0%
Update Log	9%	9%	64%	4%	14%	100%	0%	0%	100%	0%	0%	100%

Table C-19-d. *Distribution of processing effort by organization per activity classification for each type of system.*

Appendix C. Change Order Process Analysis and Results

WI	Activity Classification - Processing Effort (% Change)					
Organization	MSD	WI	GC	CM	O	TOTAL
Prepare Document	78%	85%	54%	3%	48%	**72%**
Process Document	93%	95%	89%	82%	61%	**87%**
Authorize Document	62%	62%	57%	61%	6%	**60%**
Locate Document	98%	99%	70%		71%	**83%**
Update Database	100%	100%	100%		100%	**100%**
Update Log	100%	100%	96%	100%	100%	**97%**

Table C-19-e. *Percentage decrease in processing effort due to an internet-based system.*

C.2.4.2. Distribution by Activity Skill per Activity Classification

C.2.4.2.1. Distribution of Activities by Activity Skill per Activity Classification

How does the number of activities by activity skill (managerial, technical, and clerical) vary for each activity classification for the change order process with the paper-based system vs. with an internet-based system?

When the total number of activities is distributed by activity skill for each type of activity classification, we observe the following:

Paper-based process

- Of the 729 activities to prepare documents: 5% were managerial activities, 14% were technical activities, and 81% were clerical activities.

- Of the 332 activities to process documents: 4% were managerial and 96% were clerical activities.

- Of the 58 activities to authorize documents: 90% were managerial activities, and 10% were clerical activities.

- Of the 465 activities to locate documents: 6% were managerial activities and 94% were clerical activities.

- Of the 131 activities to update the accounting database: 2% were technical and 98% were clerical activities.

- Of the 473 activities to update the log: 1% were managerial activities and 99% were clerical activities.

Internet-based process

- Of the activities to process the documents: 5% would be managerial activities and 95% would be clerical activities.

- Of the activities to locate documents: 10% would be managerial activities and 90% would be clerical activities.

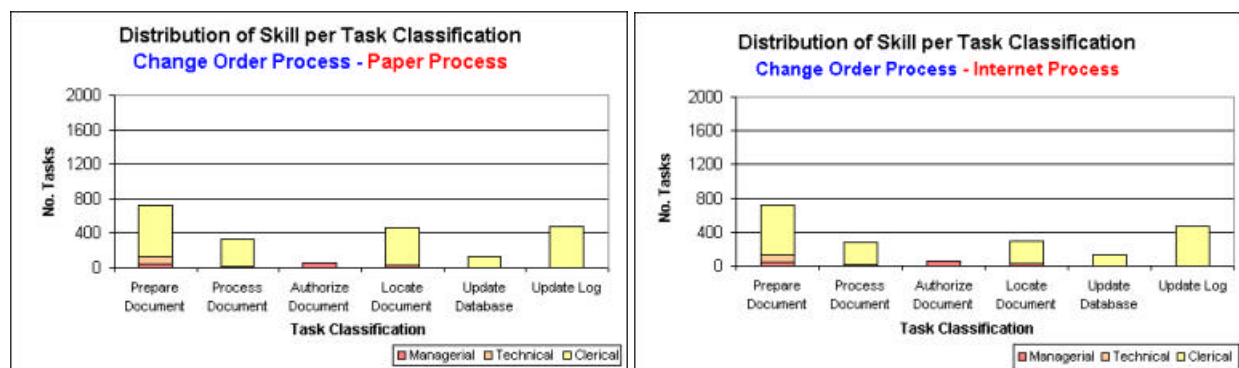- All other activity classifications would be unaffected or the effect would be negligible.

Figure C-20-a, b. *Distribution of activities by activity skill per activity classification for the change order process with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

WI	Activity Skill - Number of Activities							
	Paper				Internet			
Activity Classification	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
Prepare Document	37	99	593	**729**	37	99	585	**721**
Process Document	13	0	319	**332**	13	0	262	**275**
Authorize Document	52	0	6	**58**	52	0	6	**58**
Locate Document	29	0	436	**465**	29	0	266	**295**
Update Database	0	2	129	**131**	0	2	129	**131**
Update Log	2	2	469	**473**	2	2	469	**473**
TOTAL	**133**	**103**	**1952**	**2188**	**133**	**103**	**1717**	**1953**

Table C-20-a. *Number of activities by activity skill per activity classification for the paper-based system vs. an internet-based system.*

WI	Activity Skill - Number of Activities (%)							
	Paper				Internet			
Activity Classification	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
Prepare Document	5%	14%	81%	**100%**	5%	14%	81%	**100%**
Process Document	4%	0%	96%	**100%**	5%	0%	95%	**100%**
Authorize Document	90%	0%	10%	**100%**	90%	0%	10%	**100%**
Locate Document	6%	0%	94%	**100%**	10%	0%	90%	**100%**
Update Database	0%	2%	98%	**100%**	0%	2%	98%	**100%**
Update Log	0%	0%	99%	**100%**	0%	0%	99%	**100%**

Table C-20-b. *Distribution of activities by activity skill per activity classification for each type of system.*

How does the processing effort by activity skill (managerial, technical, and clerical) vary for each activity classification for the change order process with the paper-based system vs. with an internet-based system?

When the processing effort is distributed by activity skill for each type of activity classification, we observe the following:

Paper-based process

- Of the processing effort to prepare documents: 25% was consumed by managerial activities, 1% by technical activities, and 74% by clerical activities.

- Of the processing effort to process documents: 4% was consumed by managerial activities and 96% was consumed by clerical activities.

- Of the processing effort to authorize documents: 100% was consumed by managerial activities.

- Of the processing effort to locate documents: 9% was consumed by managerial activities and 91% was consumed clerical activities.

- Of the processing effort to update the accounting database: 100% was consumed by clerical activities.

- Of the processing effort to update logs: 3% was consumed by managerial activities and 97% was consumed by clerical activities.

Internet-based process

- Of the processing effort to prepare documents: 78% would be consumed by managerial activities, and 22% by clerical activities.

- Of the processing effort to process documents: 33% would be consumed by managerial activities, 67% by clerical activities.

- Of the processing effort to authorize documents: 100% would be consumed by managerial activities.

- Of the processing effort to locate documents: 52% would be consumed by managerial activities and 48% would be consumed by clerical activities.

- No processing effort would be needed to locate documents or update the accounting database.

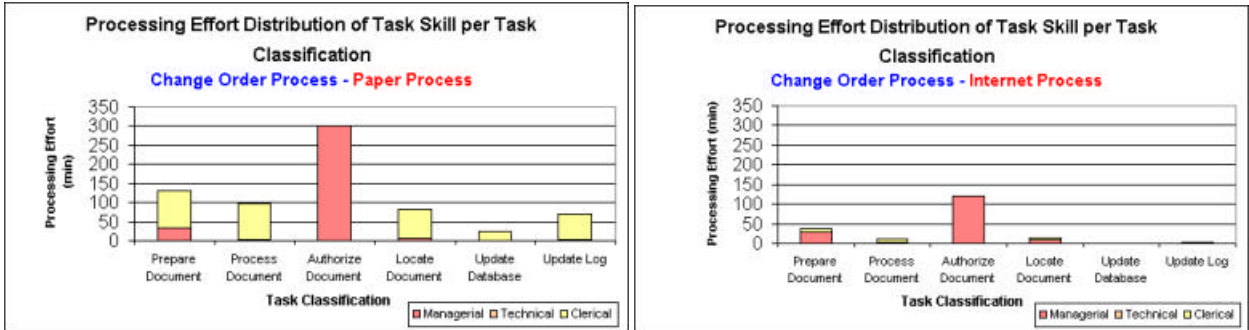- Of the processing effort to update the log: 100% would be consumed by managerial activities.

Figure C-20-c, d. *Distribution of processing effort by activity skill per activity classification for the change order process with the paper-based system vs. an internet-based system.*

Appendix C. Change Order Process Analysis and Results

| WI | Activity Skill - Processing Effort (min) | | | | | | | |
| | Paper | | | | Internet | | | |
Activity Classification	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
Prepare Document	34	1	97	132	29	0	8	37
Process Document	4	0	93	97	4	0	8	13
Authorize Document	301	0	1	302	121	0	0	121
Locate Document	7	0	74	82	7	0	7	14
Update Database	0	0	24	24	0	0	0	0
Update Log	2	0	69	71	2	0	0	2
TOTAL	348	1	358	707	163	0	23	186

Table C-20-c. *Processing effort by activity skill per activity classification for the paper-based system vs. an internet-based system.*

| WI | Activity Skill - Processing Effort (%) | | | | | | | |
| | Paper | | | | Internet | | | |
Activity Classification	Managerial	Technical	Clerical	TOTAL	Managerial	Technical	Clerical	TOTAL
Prepare Document	25%	1%	74%	100%	90%	0%	10%	100%
Process Document	4%	0%	96%	100%	31%	0%	69%	100%
Authorize Document	100%	0%	0%	100%	100%	0%	0%	100%
Locate Document	9%	0%	91%	100%	32%	0%	68%	100%
Update Database	0%	0%	100%	100%				
Update Log	3%	0%	97%	100%	100%	0%	0%	100%

Table C-20-d. *Distribution of processing effort by activity skill per activity classification for each type of system.*

WI	Activity Skill - Processing Effort (min)								
	Managerial			Technical			Clerical		
Activity Classification	Paper	Internet	% Change	Paper	Internet	% Change	Paper	Internet	% Change
Prepare Document	34	29	-15%	1	0	-100%	97	8	-92%
Process Document	4	4	0%	0	0		93	8	-91%
Authorize Document	301	121	-60%	0	0		1	0	-100%
Locate Document	7	7	0%	0	0		74	7	-91%
Update Database	0	0		0	0		24	0	-100%
Update Log	2	2	0%	-	-	-	69	0	-100%
TOTAL	348	163	-53%	1	0	-100%	358	23	-93%

Table C-20-e. *Percentage decrease in processing effort due to an internet-based system.*

C.2.4.3. Distribution by Effect on Activity per Activity Classification

C.2.4.3.1. Distribution of Activities by Effect on Activity per Activity Classification

An internet-based system would affect activities in terms of processing effort. For each activity classification, how many activities would remain the same? How many would be reduced? How many would be automated? How many would be eliminated?

When the total number of activities is distributed by effect on activity for each activity classification, we observe the following:

From the paper-based process to the internet-based process

- An internet-based system would automate 89% of the activities to prepare documents, 7% would remain the same, 3% would be reduced, and 1% would be eliminated.

- An internet-based system would reduce 9% of the activities to process documents, 5% would remain the same, 69% would be automated and 17% would be eliminated.

- An internet-based system would reduce 7% of the activities to authorize documents, 72% would remain the same, and 21% would be automated.

- An internet-based system would automate 52% of the activities to locate documents, 11% would remain the same, and 37% would be eliminated.

- An internet-based system would automate 100% of the activities to update the accounting database.

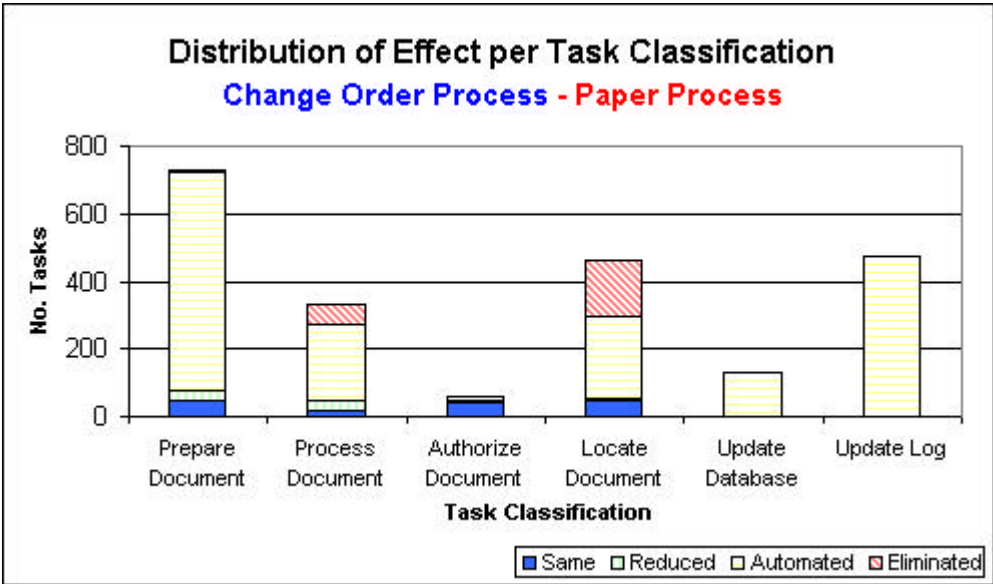- An internet-based system would automate 100% of the activities to update logs.

Figure C-21-a. *Distribution of activities by effect on activity per activity classification for the change order process due to the paper-based system vs. an internet-based system.*

WI	Effect - Number of Activities				
Activity Classification	Same	Reduced	Automated	Eliminated	TOTAL
Prepare Document	50	25	646	8	729
Process Document	17	29	229	57	332
Authorize Document	42	4	12	0	58
Locate Document	50	2	243	170	465
Update Database	0	0	131	0	131
Update Log	2	0	471	0	473
TOTAL	161	60	1732	235	2188

Table C-21-a. *Number of activities by effect on activity per activity classification.*

WI	Effect - Number of Activities (%)				
Activity Classification	Same	Reduced	Automated	Eliminated	TOTAL
Prepare Document	7%	3%	89%	1%	100%
Process Document	5%	9%	69%	17%	100%
Authorize Document	72%	7%	21%	0%	100%
Locate Document	11%	0%	52%	37%	100%
Update Database	0%	0%	100%	0%	100%
Update Log	0%	0%	100%	0%	100%

Table C-21-b. *Distribution of activities by effect on activity per activity classification.*

An internet-based system would affect activities in terms of processing effort. For each activity classification, how much of the processing effort would remain the same? How much would be reduced? How much would be automated? How much would be eliminated?

When the processing effort is distributed by effect on activity for each activity classification, we observe the following:

From the paper-based process to the internet-based process

- An internet-based system would reduce 9% of the processing effort to prepare documents, 24% would remain the same, 64% would be automated and 3% would be eliminated.

- An internet-based system would reduce 27% of the processing effort to process documents, 8% would remain the same, 33% would be automated and 32% would be eliminated.

- An internet-based system would automate 80% of the processing effort to authorize documents and 20% would remain the same.

- An internet-based system would automate 62% of the processing effort to locate documents, 17% would remain the same, and 21% would be eliminated.

- An internet-based system would automate 100% of the processing effort to update the accounting database.

- An internet-based system would automate 97% of the processing effort to update logs, and 3% would remain the same.
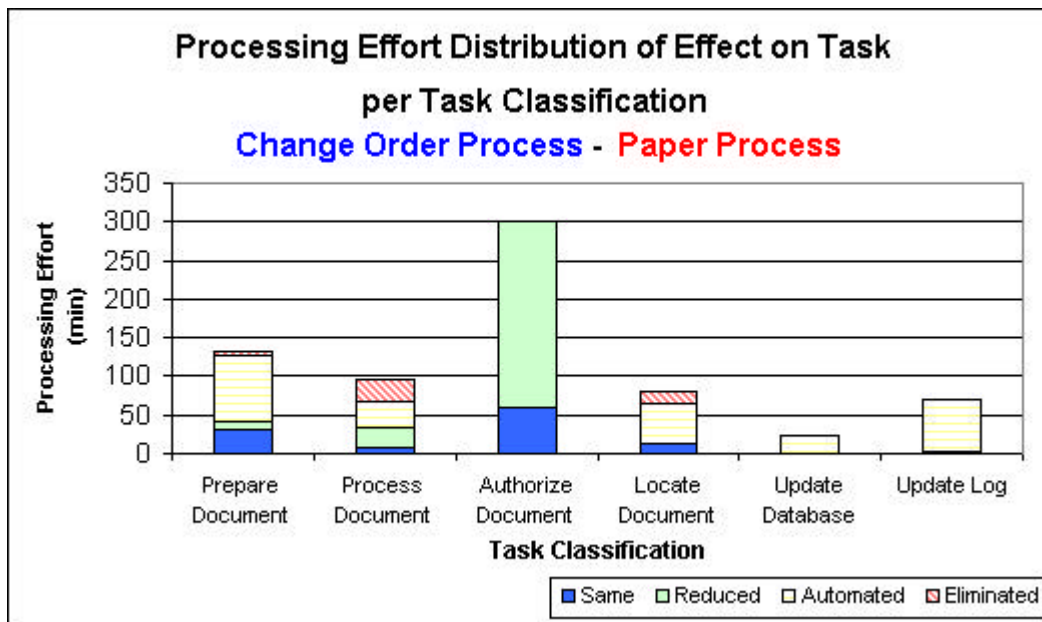

Figure C-21-b. *Distribution of processing effort by effect on activity per activity classification for the change order process due to the paper-based system vs. an internet-based system.*

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WI	Effect - Processing Effort (min)				
Activity Classification	Same	Reduced	Automated	Eliminated	TOTAL
Prepare Document	31	12	85	4	132
Process Document	8	26	33	31	97
Authorize Document	61	240	1	0	302
Locate Document	14	0	50	17	82
Update Database	0	0	24	0	24
Update Log	2	0	69	0	71
TOTAL	115	278	262	52	707

Table C-21-c. *Processing effort by effect on activity per activity classification.*

WI	Effect - Processing Effort (%)				
Activity Classification	Same	Reduced	Automated	Eliminated	TOTAL
Prepare Document	24%	9%	64%	3%	100%
Process Document	8%	27%	33%	32%	100%
Authorize Document	20%	80%	0%	0%	100%
Locate Document	17%	0%	62%	21%	100%
Update Database	0%	0%	100%	0%	100%
Update Log	3%	0%	97%	0%	100%

Table C-21-d. *Distribution of processing effort by effect on activity per activity classification.*

In conclusion, our analysis shows internet-based systems can be very useful in streamlining the change order process and making the best use of people's talents by taking advantage of technology to automate clerical and technical activities and also to eliminate paper-based activities that are no longer relevant.