

The Safety - Productivity Balance and its Association with Human Factors and Safety Awareness and Communication

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Background

- Continuous growth of aircraft manufacturing business
- Human Factors & Safety education/training and communication are vital elements to manage this growth effectively
- Literature suggests that:
 - Productivity increases with more comfortable and safer working environment
 - Knowledge on human factors not always transformed into practice
 - Safety skills are mostly developed through experience
 - Inevitable trade-offs amongst multiple objectives generate dilemmas and ambiguities
 - It is necessary to achieve a productivity-safety equilibrium



Background

- In addition to education/training, safety communication:
 - Reinforces human factors & safety principles taught
 - Enhances awareness of hazards
 - Increases understanding of implications of safety infringements
 - Shapes common perceptions and ensures alignment regarding objectives
 - Resolves conflicts between production and safety goals



Study motivation and hypotheses

- Little research whether awareness of influences of human factors and safety rules on task performance affects the balance between safety and productivity (aviation manufacturing).
- **HYP1:** The more the awareness about human factors and safety, the more the favor of safety over productivity
- **HYP2:** The more the human factors and safety communication, the more the favor of safety over productivity

Research design

- Self-developed survey to capture perceptions:
 - **RQ1:** To what extent do employees favor safety over productivity?(8 questions)
 - **RQ2:** To what extent are employees aware of the effects of safety rules and human factors on their tasks? (13 questions)
 - **RQ3:** How sufficiently do managers and supervisors communicate with employees regarding human factors and safety? (9 questions)
- Questions based on literature review, pilot test and peer-reviews to achieve relevance, proper length & adequate coverage and clarity
- Four-point Likert scale per question
- Additional demographic questions: company, level of experience, type of employment and weekly working hours



Themes covered

- Knowledge about human factors and safety practices
- Improvement through learning
- Distraction and attention when performing tasks
- Effects of the working environment and respective interactions
- Nature and demands of tasks
- Body postures
- Communication
- Attitude towards safety rules
- Use of personal protective equipment
- Efficiency-thoroughness trade-offs

Study sample (37 participants)

Variable	Independent Variable	Sample Percentage	Plant A	Plant B
Plant	Plant A	78.4%		
	Plant B	21.6%		
Years of employment in the company	≤5	64.9%	62.0%	75.0%
	6 to 10	29.7%	31.0%	25.0%
	≥11	5.4%	7.0%	0%
Employment status	Full Time	89.2%	86.3%	100.0%
	Apprentice	10.8%	13.7%	0%
Working hours per week	31 to 40	48.6%	41.4%	75.0%
	41 to 50	51.4%	58.6%	25.0%

Data analysis

- Mann-Whitney/Kruskal-Wallis tests: Demographic variables VS
 - Safety and productivity balance (RQ1)
 - Awareness about human factors and safety rules (RQ2)
 - Safety communication between supervisors/managers and technicians (RQ3)
- Spearman's bivariate correlations to explore possible associations of RQ1 with RQ2 and/or RQ3.

Results: Overall picture

Research question	Total number of questions	Number of Questions per Median (scale 1-4)		
		Median: 2	Median: 3	Median 4:
Safety and productivity balance (RQ1)	8	4	3	1
Awareness about human factors and safety rules (RQ2)	13	3	10	-
Safety communication between supervisors/managers and technicians (RQ3)	9	5	4	-



Discussion: Overall picture

- Employees were aware of the role of human factors and safety rules in their job performance
- There was adequate communication between management and staff around those topics
- Safety did not always appear as a top priority:
 - workers showed a tendency to balance safety with production requirements
 - employees self-organized their safety obligations during their day-to-day activities

Results: Statistics (1 / 3)

No association between RQ1, RQ2 and RQ3 with demographic variables

Question (P: positively formulated, N: negatively formulated)	Statistical Significance (p)	Mean Ranks		
		Plant A	Plant B	
P: The supervisors of my company regularly talk to employees about work safety practices and rules	0.006	16.62	27.63	
P: The supervisors of my company talk to staff about safety aspects of newly introduced tasks	0.030	17.02	26.19	
P: Supervisors of my company pass to management safety concerns of employees	0.001	16.22	29.06	
N: Management of my company sometimes does not make practical rules about safety because managers have a limited understanding of the processes that staff uses to perform tasks	0.019	16.50	25.50	
P: Lack of appropriate work tools will lead to task stoppage and inquire for proper tools on the expense of task duration	0.003	21.36	10.44	
		Employment Length (years)		
		≤5	6 to 10	≥11
N: Work errors are caused only when people interact with other parts of their working environment	0.040	17.67	18.91	35.50
		Employment Type		
		Full-time	Apprentice	
P: Repetitive tasks cause less focus on the process	0.042	17.91	28.00	

Discussion: Demographic variables

- **Common overall perceptions** amongst workers regardless of the company, employment length and status, and weekly working hours
- **Communication questions differences:** lower complexity of the small company due to fewer employees and limited scope of operations
- **Working environment question difference:** as working experience increases, the awareness of how local factors affect human performance becomes more profound
- **Repetitive tasks question difference:** full-time employees (overconfidence?) and apprentices (recent introductory training?)

Results: Correlations (1/2)

- Whole sample:
 - Positive monotonic relationship between Safety and productivity balance (RQ1) and Awareness about human factors and safety rules (RQ2), (N=37, $\rho=0.502$, $p=0.002$).
 - No association between RQ1 and Safety communication between supervisors/managers and technicians (RQ3)

Results: Correlations (2/3)

- Across demographic variables:
 - RQ1 & RQ2 statistically significant for:
 - Plant A (N=29, $\rho=0.548$, $p= 0.002$)
 - 0-5 years employment, (N=24, $\rho=0.473$, $p= 0.000$)
 - Full-time employees (N=33, $\rho=0.533$, $p= 0.001$)
 - RQ1 & RQ3 statistically significant with a negative direction for ≥ 6 years employment (N=11, $\rho= -0.682$, $p= 0.021$)
- Partial correlations:
 - When controlling RQ3, still significant results for RQ1 & RQ2 (N=34, $\rho= 0.626$, $p= 0.000$).
 - When controlling for RQ2, still no significant results for RQ1 & RQ3

Discussion: Correlations

- Overall sample:
 - Positive effects of human factors and safety training on minimizing adverse outcomes that source from production pressures
 - Communication did not affect the equilibrium between safety and productivity
- Stronger effects for larger company, workers with a few years' employment and full-time employees -> **more (real or perceived) production demands and variations?**
- Employees under longer employment: the more the communication, the higher the favor of productivity over safety -> **quality of communication and/or interpersonal relations?**

Final remarks & recommendations

- Quality and complexity factors might influence effects of safety-related practices on specific parts of the population -> **customisation of safety training and communication to specific characteristics of employees**
- **Further research about the efficiency-thoroughness trade-off** either separately or in conjunction with the perceptions of staff on human factors, safety rules and communication
- Additional research regarding the **significant associations that could not be evaluated against the literature reviewed**
- Customization of similar questionnaires to **the needs of any organization**
- Validation and explanation of future results through **interviews, observations or other suitable methods**

INTERNATIONAL CROSS-INDUSTRY SAFETY CONFERENCE AND EUROPEAN STAMP WORKSHOP AND CONFERENCE 2018 (31 OCT. – 2 NOV. 2018)



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Thanks! Questions?

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