



SUSTAINABLE APPROACH TO BOOK DESIGNING CONCEPTS IN BINDERY SECTOR: AN OVERVIEW

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Introduction



Graphic arts bindery sector has shown growing environmental awareness in reaching the targets regarding economic, social, environmental, and technological aspects. Sustainable bindery concepts are strictly related to effective printed resources usage, in which the generated waste is reduced through numerous binding manufacturing activities. Bindery eco-efficiency concepts cope with manufacturing service activities, in which the printed paper sheets together with binding raw materials move through the machine operations, which are predictable in edition binding. INTERGRAF supports competitiveness and recommends environmental indicators. Nowadays, printing industry suppliers sell different types of consumable graphic art materials. It is important to replace them with eco-friendly chemicals whenever possible. Reduced environment load appears only if the engineering design process has reduced impact on environment. It means that sustainable "green book designing" calls upon to use education and knowledge to apply solutions which are sustainable. The eco-strategy, in business systems, require tailoring work procedures and tools which are strictly used in order to put environmental working on high level. Business operational activities refer to superiority in functionality, in which individual generates greater organization value.

Problem Description



This study provides a comprehensive overview on how a new approach in book designing might contribute to reducing "non-hazardous" printed or/and bound paper output residuals which gradually appear in a specific way during book binding process. This eco-efficient bound production is monitored as well as the indices of graphic arts materials are followed up throughout the working procedures under standardized circumstances. These innovative creative thinking might bring up sustainable engineering solutions or frameworks in which "the business as usual" shifts towards "the eco-friendly business". Eco-labeled printed paper sheets, are a sustainable choice which encourages responsible business and leads to zero pollution and circular economy. However, scientists have been worried about the fact that many manufacturing sectors rely on using adhesives with non-renewable resources, which are harmful to humans. Present published literature gives a general overview on the existing advanced adhesives which have less harmful impact on environment, but at the same time have promising performances. The government should certainly support the improvement of science and technology capacities and promote more environmentally friendly manufacturing patterns. Therefore, the rules and regulations towards more sustainable book products should become a priority in developing the advanced solutions, in which "green book" products are recycled or biodegraded as well as the manufacturing waste being returned the closed-loop.

Sustainability in Bindery



From ecological point of view, environmentally friendly-books production on recycled eco-labeled fine papers and advanced adhesives provides sustainable business management on the global market. Paperback edition books are widely represented in bindery sector because they play an important role in contemporary education and find their riders more easily. It explains why publishers release a large number of paperbacks at once to bring the cost per bound book unit down. However, lots of them don't get sold, and end up in recycled paper for other uses. The lower negative environment impact can be avoided though lower carbon footprint and chose sustainable bound-book solutions. Commercial perfect binding system provides a wide variety of binding capabilities in large production runs, but thermal adhesive is a major pollutant in book productions due to hazardous VOCs emissions during its application on book blocks. This contemporary binding method need to be continuously up to date with new environment strategies and goals which should be realized through implementation of advanced "eco-friendly" graphic arts materials, which contribute to eco-efficiency. Hence, the circular economy is crucial, bindery sector must improve waste and materials management. The issue di-

Conclusion



A growingly agile supply chain, including models in-line and on-demand production, responds to market needs for sustainable manufactured solutions and advanced graphic arts product values. The printing sector sticks together with the sector of bindery service that shift towards sustainable concepts of engineering designed book products. Achieving economic growth and sustainable development should be reached by using advanced graphic arts materials (eco-labeled papers and adhesives), which lead towards efficient management of natural resources. Because implementing environmental framework (DfE method) in bindery manufacturing creates opportunities to improving good practices in eco-engineering designing. Sustainable manufactured book products should follow the real consumer needs avoiding books storage through the long period of time. According to the United Nations development program 2022-2025, business systems should be more environmentally aware of hazardous non-renewable graphic arts materials and should replace them with bio-based ones, buying certified "eco-graphic arts materials". The sustainable "green book designing", for the future, should move away from a traditional linear book manufacturing to a circular one. The advanced book engineering concepts should lead to creating disposal stage of book products, creating a new environmentally friendly books. New sustainable strategies should inspire the engineers to re-think and re-design book products towards a circular economy by improving its efficiency. Life cycle of book product ("from cradle to grave") goes through many stages, from usage natural resources such as energy and water for producing certified virgin paper to making technological waste, pollutants and greenhouse gas emissions in manufacturing. Another negative impact on the environment is transport solutions. The digital bookselling would be more preferable option. Furthermore, manufactured book purpose should correlate with its function, efficiency, appearance and durability as well as the choice of graphic arts materials (papers, adhesive and accessories), which need to follow the book task. Book disposal at end of its life cannot be explained through what consumers or book publishers do with the produced book. Accordingly, the eco-book designing concepts should make a smart step forward to improving the environment outcomes and reducing costs in the long-term. Foremore, International Framework ISO/TC 130 Standards for Graphic technology should take responsible roles to creating the new initiatives for developing sustainable practices which will maintain and ensure natural system solutions which will contribute to higher standards of leaving.

Design & Environment method	Graphic art materials indicators		Only bindery service: Mass-bound book production Copy > 100		Bound book production on demand, Copy < 100	
	PLASTIC PAPER, INKS	PAPER, INKS, ADHESIVE	PAPER SAWDUST	EVA hot melt ADHESIVE	ADHESIVE PLASTIC, PAPER, INK	PAPER SAWDUST
Potentially hazardous waste:						
Hard recycling waste:		*			*	
Partially recycling waste:	*				*	
Recycling waste:						
Neglecting waste:						

*Residuals of bound book production

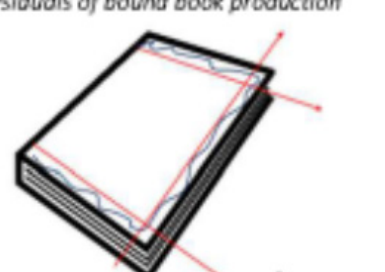


Figure 1

Comparison environment impacts of each included graphic art materials in bound book production

rectly related to the problem in synthetic resins of hot-melt adhesives. Synthetic polymer waste accumulations can be minimized through sustainable approaching of Design and Environment method usage (Figure1). It is noticed that synthetic resins have negative environmental impact. That problem could be avoided if the book construction is designed correctly. The VOCs emission cannot be avoided due to petrochemical components in adhesive that is potentially hazardous waste. And in the environmental management is marked on DfE method list as undesirable waste. The "eco bound-book engineering" need to encourage the enhancing of waste management in the future.

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