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DYNAMICS AND IMPACT OF DIGITAL FOOTPRINT ON PROJECT SUCCESS

Abstract: The digital footprint of the project is its integral characteristic, reflecting both the "official" information on the project, unnecessary and any mention of the project including social networks and other Internet resources. An entropy model for assessing the success of a project is proposed. The model covers the content (semantic part), its environment, and the dynamics of implementation. The increase in informational entropy (uncertainty) of the project cannot be estimated as the sum of the increase in entropy associated with each element of the digital footprint. The main reason for this is the synergy inherent in the digital footprint. Separately insignificant elements of a digital footprint of a project of a negative nature, with their significant number and periodic appearance, cause a "snowball" effect, which leads to an increase and exaggeration of small destructive effects of individual digital footprints. Therefore, it makes no sense to consider the increase in information entropy for each element of the digital footprint of the project, but it is necessary to consider the impact of each new element of the digital footprint on the information entropy of the project. Each element of an active digital footprint is formed on time and meets the necessary requirements. The organized formation of a digital footprint promotes order in documentation, timely awareness of risks, the formation of the required level of demand for a project product, and a proactive assessment of success. The digital footprint should also help attract new stakeholders to create a favorable project image and promote the project's product. The fulfillment of this set of conditions ensures a decrease in entropy and, as a result, the success of the project. Conversely, if active and passive digital traces of a project increase entropy, then the likelihood of project success is reduced.

Keywords: digital footprint, information, digitalization, structure, active, passive digital footprint.

Introduction

Information, information environment, digitalization, digital footprint and digital shadow are integral parts of both organizations and individuals in the modern world. Information is practically no longer considered as something that exists without reference and outside of digital technologies. Any private information becomes part of the information space of social networks, for example [1, 2, 3].

Thus, information today is not only a resource that makes it possible to make certain decisions both by individuals in personal matters and by managers of various levels for individual tasks, projects or organizations as a whole [4, 5]. Information is a source of information entropy and, depending on the direction and controllability of the information resource, entropy decreases or increases, forming a danger or favoring the organization. Such issues, in particular, were considered in works [6, 7, 8], where a generalized formalization of the influence of information and information environment of an organization and / or projects on the viability and success of projects and organizations through entropy is proposed [9, 10]. Thus, the new entropy theory of project and organization management [11, 12, 13] considers information not just as one of the organization's resources, but as the main factor influencing entropy.

The concept of a digital footprint is also associated with the modern approach to information. This category only finds its application in the management of projects and organizations. Since a digital footprint arises even when it is necessary to ensure its absence (for example, classified information), it is natural to consider the digital footprint as a new object in the management of projects and organizations.

In this study, the digital footprint is examined at the level of an individual project in order to identify its structure, dynamics and impact on success, in order to further develop these ideas to project-oriented organizations as a whole.

The structure of the digital footprint of the project

The digital footprint is an integral characteristic of the project, reflecting both the "official" information on the project (active digital footprint), and any mention of the project (including social networks and other Internet resources).

An active digital footprint is formed intentionally and includes both project documentation and project information generated within the framework of project marketing (advertising and PR events) to create a certain image of the project and its future results (Fig. 1).
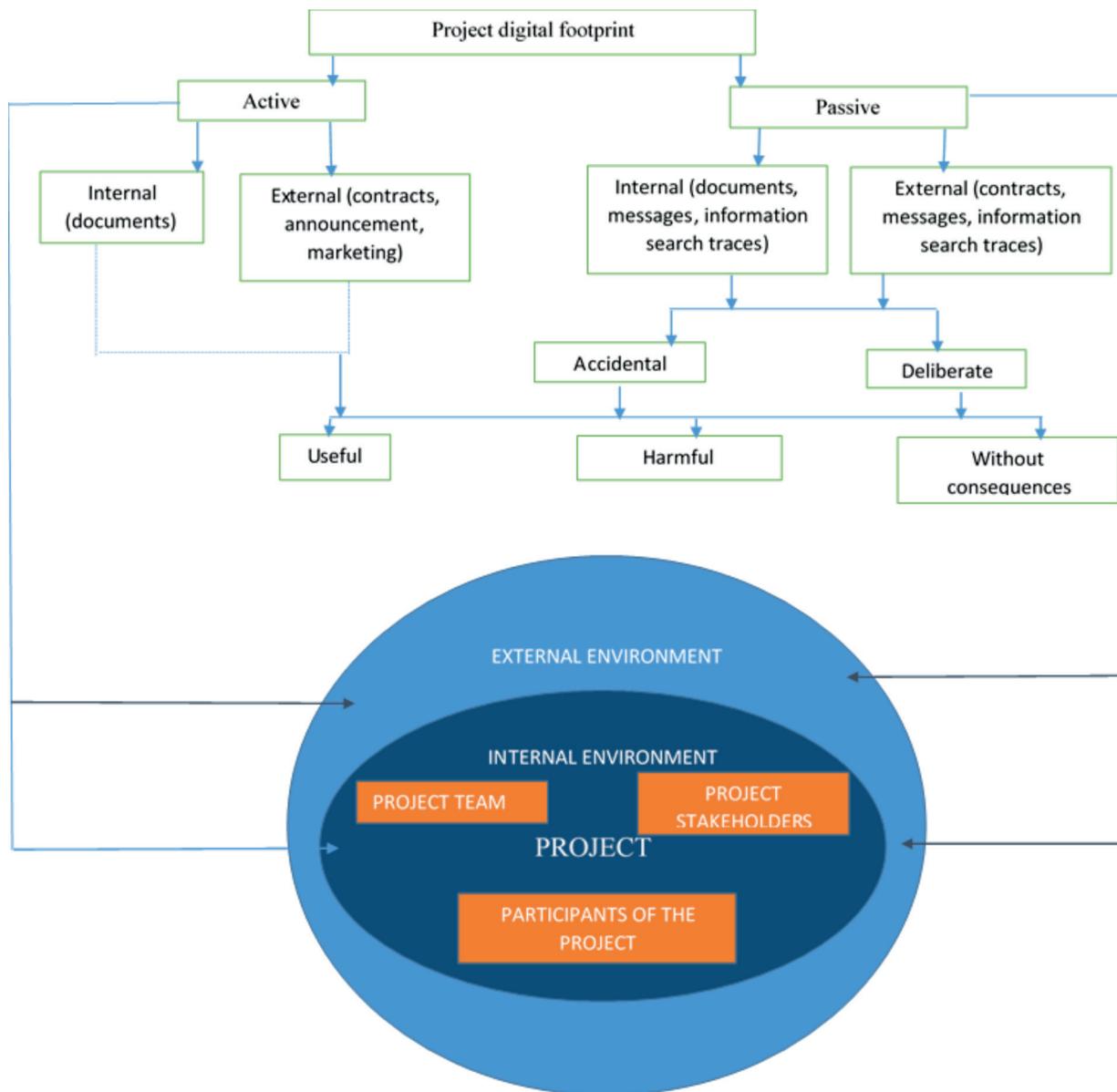
Fig. 1. The structure of the digital footprint of the project in terms of its content

Thus, an active digital footprint includes both internal information on the project (which is intended for the project team of stakeholders and participants), and information intended for external use (various announcements, including vacancies, advertisements, etc.). The external component of the information footprint is the result of information support of the project's relationship with the external environment.

A passive digital footprint is formed as "leaked" information on a project, that is, information that was not originally intended for its active dissemination in the environment. Moreover, the latter can be both internal and external. An internal passive digital footprint is formed as an accidental or deliberate distribution of a piece of information on a project to those participants or managers who should not be aware of it. Accordingly, an external passive digital footprint is formed as an accidental or deliberate dissemination of such information on a project to an external environment that is not intended for this.

The result of the existence of a certain passive digital footprint can be both useful for the project (for example, as additional advertising of the project and its product), and harmful (for

example, if the information negatively reflects the project or its product). It is also possible that the passive digital footprint has no project implications. Note that a passive digital footprint is formed as documents "open" for access, oral or digital messages of various kinds (for example, the project manager posted his photo on the social network with project participants or stakeholders, for whom it would be preferable not to disseminate information about their participation in the project). In addition, the results of searches or queries by managers or project participants for individual information also form a passive digital footprint on the subject of the search.

Thus, the digital footprint of the project, both active and passive, is associated with specific persons (team members, participants or stakeholders).

The usefulness or harmfulness of a passive digital footprint for a project can be assessed by the influence on the change in the entropy of the project. If a passive digital footprint provides a reduction in information entropy, then this is a boon for the project, and vice versa otherwise.

It should be noted that an active digital footprint also affects both positively and negatively the information entropy of the project. And each new document or advertising information either contributes to more definite results of the project, reducing its entropy [6], or not.

Impact of the digital footprint of a project on its success

A project is successful if it is delivered on time and within the specified resources, delivering the planned product, results, value and effectiveness. According to [3, 6], entropy is what prevents a project from being successful, therefore, a decrease in entropy ensures the success of the project.

It was defined above that the digital footprint of a project of any nature can affect the entropy of the project.

The digital footprint of a project can be thought of as a collection of individual digital footprints generated by various sources (documents, people, situations, etc.).

Let's denote:

$PDFA_i^k, i=\overline{1,n}, k=\overline{1,K}$ – an active digital footprint of a project of a specific type k associated with a specific source i;

$PDFP_i^k, i=\overline{1,n}, k=\overline{1,K}$ – a passive digital footprint of a project of a specific type k associated with a specific source i;

H – information entropy of the project;

ΔH – change in the information entropy of the project. Note that it can be either more or less than 0.

Then it is true:

$$PDF = \bigcup_{i=1}^{n} \bigcup_{k=1}^{K} (PDFA_i^k + PDFP_i^k),$$ (1)

where PDF – digital footprint of the project.

Each element of a project's digital footprint affects information entropy, which can be mathematically described as follows:

$$\Delta H(PDF) = \Delta H(\bigcup_{i=1}^{n} \bigcup_{k=1}^{K} (PDFA_i^k + PDFP_i^k)) =$$
$$= \varphi(PDFA_i^k, PDFP_i^k, i=\overline{1,n}, k=\overline{1,K}),$$

(2)

where is a certain function that reflects the result of the joint influence on the entropy of the project of all elements of the digital footprint.

It should be noted that the increase in the information entropy of the project cannot be estimated as the sum of the increase in entropy associated with each element of the digital footprint. The main reason for this is the synergy inherent in the digital footprint. As an example: individually insignificant elements of a digital footprint of a project of a negative nature (that is, negatively affecting the project), with a significant number and periodic appearance, cause a "snowball" effect, which leads to an increase and exaggeration of small destructive effects of individual digital footprints. Therefore, it makes no sense to consider the increase in information entropy for each element of the digital footprint of the project. It makes sense to consider the impact of each new element of the digital footprint on the information entropy of the project.

Thus, the impact of digital footprint on project success can be schematically represented as follows (Figure 2).
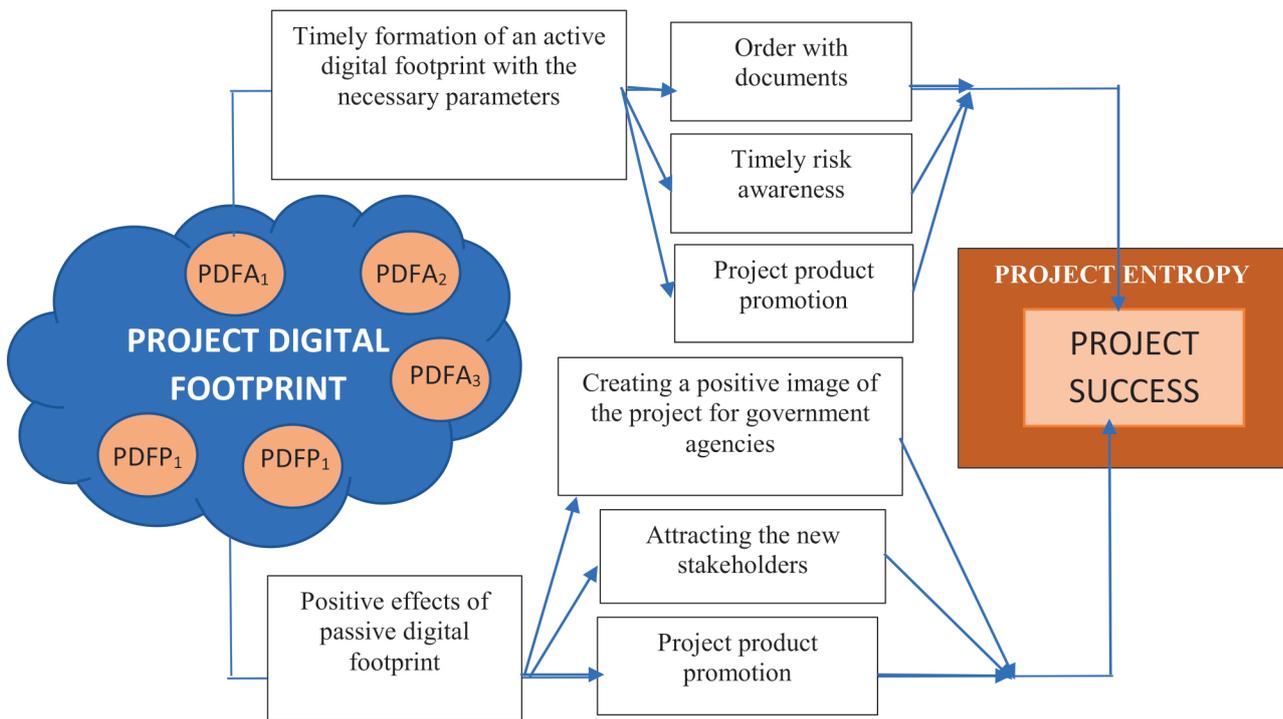

Fig. 2. Impact of the digital footprint of the project on the success of the project

Each element of an active digital footprint must be formed on time and meet the necessary requirements (that is, be described by the specified parameters). Properly configured and organized formation of an active digital footprint contributes to order with documentation, timely awareness of risks, and the formation of the required level of demand for the project product. A passive digital footprint should also help attract new stakeholders or participants, create a favorable image for the project, and promote the project's product. The fulfillment of this set of conditions ensures a decrease in entropy and, as a result, the success of the project.

Conversely, if active and passive digital traces of a project increase entropy, then the likelihood of project success is reduced.

Dynamics, background and implications of the digital footprint of the project
The digital footprint of a project is formed and changed over time. Its life cycle is significantly longer than the life cycle of a project. It would be misleading to believe that the digital footprint lifecycle of a project begins at the same time point as the project lifecycle. The above-mentioned specificity of the modern world - everything has a digital footprint - is reflected in the fact that the managers, stakeholders, participants involved in the project already have a certain digital footprint (Fig. 3).
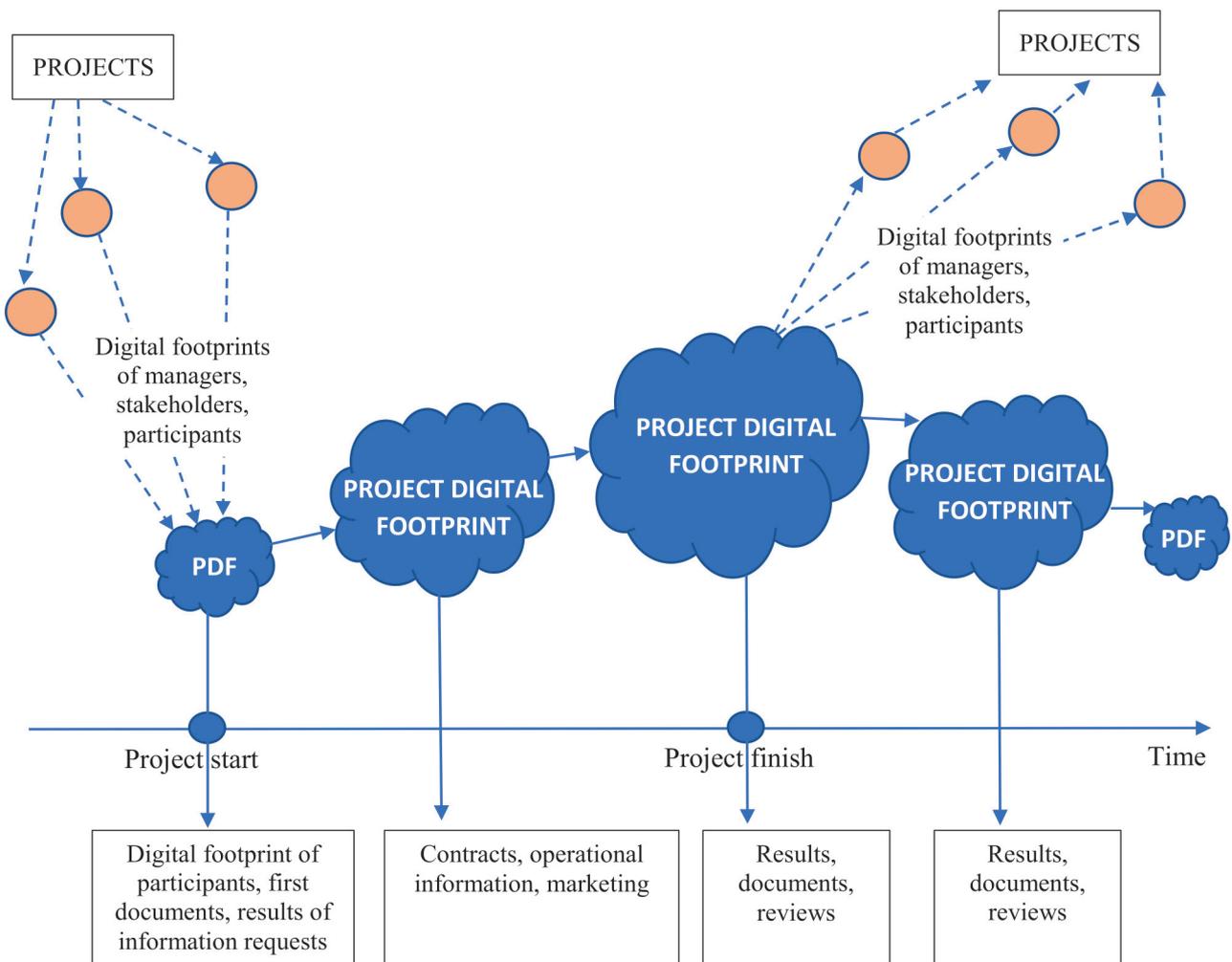

Fig. 3. Dynamics of the digital footprint of the project

Moreover, the project is associated with certain technologies, resources, geographical location, etc., which also has a digital footprint. Therefore, at the moment of the actual emergence of the digital footprint of the project at the initial point of the project life cycle, what is mentioned above, "drags its tail" from its background to the beginning of the project.

The situation is similar with the end of the project: the project is finished, but its digital footprint "lives", for example, in the form of documentation, information on the Internet. In addition, project managers, project participants and stakeholders "pull" the individual elements of the digital footprint of the project further in time. Thus, the certainty of the continuity of

projects is ensured through the digital footprint: managers bring with them to the next project elements of the digital footprint of previous projects in which they participated.

That is why a "positive" digital footprint brought from the past to a project by someone will contribute to the positive nature of a passive digital footprint of the project and vice versa. Therefore, practice has developed the skill to attract successful managers to the project, who, by their mere presence in the project, can have a positive impact, contributing to the reduction of entropy.

Each stage of the project life cycle is accompanied by a new contribution to the digital footprint of the project (Figure 3). For example, at the end of a project, there are already first reviews about it and its product (as an active and passive digital footprint), as well as information on the implementation results, including success (both active and passive digital footprint). After the end of the project, its documentation, feedback and information on the results still exist until all digital traces disappear. Although today practically nothing can disappear in the digital space, any traces of the project participants and the project itself live as long as the digital world lives.

Conclusion

The digitalization of the modern world leads to the importance of such a category as a "digital footprint" for those areas of knowledge where previously it was not even considered as an object for research.

The project and project activities are implemented in the conditions of the formation and dynamic change of the digital footprint, the essence and structure of which were determined in this study. The analysis of the sources and the type of elements of the digital footprint of the project made it possible to construct a classification of its elements. The relationship between the digital footprint of the project and its information entropy has been determined; the main options for the positive and negative impact of the digital footprint on the success of the project through the reduction of information entropy have been established. The dynamics of the digital footprint of the project have been analyzed and the relationship between the project life cycle and the duration of its digital footprint has been established.

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