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Text-organising metadiscourse markers in academic texts

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Abstract

This study aims to investigate the use of text-organising metadiscourse markers as a means of the author's stance expression in academic texts from a cross-linguistic and cross-disciplinary perspectives. This comparative study analyses scientific research articles in the fields of technology and social sciences (economics) written in Lithuanian and English. The results of the study revealed that the authors of the studied articles tend to create a coherent text, therefore the markers such as transition, endophorics, and references to the text are quite often. The more frequent evidentials, which are intended to refer to the publications of other authors, show the individual choices of the authors in the field of technology, probably determined by the peculiarities of the discipline or the requirements for publications of the scientific journals regarding the scope and organisation of the text. The results of the quantitative research demonstrated that more text-organising markers were found in the articles written in Lithuanian rather than English. The cross-disciplinary research indicated that authors use text-organising markers in the scientific articles of economics more often than the authors of technological academic texts, which means that disciplinary differences prevail. Qualitative research disclosed cross-linguistic and cross-disciplinary similarities, as the analysed examples of markers were employed by authors to perform the same functions. Furthemore, a similar perception of the organisation of the text emerged. No qualitative differences were observed in the use of the text-organising markers.

Keywords: academic texts, markers, expression of the author's stance, cross-linguistic and cross-disciplinary research

1 Introduction

The interest in exploring the peculiarities of scientific text creation and the importance of metadiscourse for this process emerged at the end of the 20th century. Although, this area is being widely explored covering different aspects: from the change of the definition of metadiscourse to parallel cross-linguistic and cross-disciplinary research. Recently, in the context of scientific discourse study, great attention has been paid to various strategies of text creation and structure, the importance of separate linguistic devices for text creation and building relationships with a reader. Metadiscourse is an inseparable part of these studies as its major function is to create a coherent text using linguistic devices, otherwise known as metadiscourse markers, connect it with the context and reach the target audience by establishing multifaceted relationships between the addresser and the addressee. Exploring the peculiarities of academic text creation and its specific features, it is vital to consider what has a greater influence on a scientific text: the conventions and traditions common to the particular discipline or the target language of the article (Šinkūnienė, 2014, p. 13). Moreover, highlighting the bonds between academic discourse and metadiscourse, the significance of metadiscourse for the creation and organisation of a successful academic text is emphasised.

The success of creating an academic text probably depends on metadiscourse, as it helps to create a coherent text and establish a relationship with the reader, accept different standpoints, and present convincing, well-supported arguments. To achieve the goal, the author applies linguistic elements common to academic discourse, in other words, metadiscourse markers of text organisation, as well as specific elements of the area of science and genre (Hyland, 2015; Hyland and Tse, 2004; Šinkūnienė, 2011). According to Šinkūnienė (2013), the academic discourse researched in various aspects reveals the peculiarities of the creation and structure of academic texts, the nature of argumentation and rhetoric, suggestiveness and the features of the use of metadiscourse, which help to reveal the author's proposition and establish a relationship with the reader.

Meanwhile, Hyland and Jiang (2018) note that academic writing has recently become less formal due to the use of metadiscourse markers that helps to express the author's stance, engage the reader and establish a relationship with one. The study carried out by the scholars revealed that the authors of academic texts employ more metadiscourse markers, which help to write a logical, more understandable text for the reader and use fewer

markers to showcase the author's stance in regard to establishing a direct connection with the reader. Scholars assume that it is more important for the authors of academic texts to guide a reader through the explicitly coherent text and comply with disciplinary and/or institutional requirements, and therefore focus more on the function of text creation and organisation.

The term *metadiscourse* is defined differently as well as the classification of the metadiscourse varies from scholar to scholar. In addition, to the overall broad perception of the metadiscourse, some scholars apply the term *metalanguage* instead of metadiscourse. This tendency is more pronounced among scholars who, when explaining the concept of metadiscourse, limit themselves to the features of the text that help organise 'text as text' (Hyland, 2015), thus bringing the understanding of the term closer to the definition of *metalanguage*. The concept of the term *metalanguage* as 'text about the text' reveals the importance of language when it is intended for both examining the chosen topic and commenting on the writing process: summarising the previous text, commenting on what will be written in the next chapter, clarifying how information is used when creating the text (Župerka, 2012). Thus, according to Župerka (2012), metalanguage reveals to the reader how the text is organised, therefore it can also be called *metatext*, which is related to the type of discourse, as, according to the scientist, *metatext* is a characteristic of academic discourse and metalanguage is a feature of non-scientific texts. Marcinkevičienė expresses a similar opinion and asserts that the author uses metalanguage to present the topic, reveal its essence, indicate literature, theories and methods applied, explain the need for the information provided, show the connections between the topics discussed in the text (Šinkūnienė, 2014). All this is created by linguistic means (metadiscourse markers of text organisation, such as transitions, code glosses, frame markers, endophorics and evidential markers), which create both a coherent text and involve the reader in the process of text creation. This is also emphasised by Hyland and Tse (2004), who claim that metadiscourse is a kind of linguistic resource that helps the author to organise the discourse and stance concerning the addressee.

Mauranen also narrows the concept of metadiscourse restricting it to text organisation features, which she calls *metatext*, thereby excluding the author's perspective and stance, thus limiting it to the elements of text creation and organisation (Hyland, Wang, & Jiang, 2022). Jacobson defines metadiscourse as a metalinguistic function of language, while Halliday attributes it to *metaphenomena*, which refers to categories of language (Hyland, 2017). Meanwhile, Šinkūnienė (2014) divides it into such levels as *metaparagraph, metasentence, metaword, metasign, metadescription* and so on. Tang (2021) also emphasises the importance of metalanguage as a specialised language describing the language itself. This is also used to convey language as a means of representation and social interaction most frequently in applied linguistics and language education.

Meanwhile, Hyland (2017) accentuates the difference between metadiscourse and metalanguage by stating that, fundamentally, metalanguage is related to knowledge about language and its representation, so it allows us to analyse and communicate the ideas about what language is and what it should be. Whereas, metadiscourse is close to metapragmatics, as it is related to the communicative behaviour of the text creator as well as the appropriate employment of linguistic elements to convey impressions and create interpersonal alignment, so the metapragmatic dimension of language allows a competent language user, in this case, the text creator, to create interaction with the addressee.

Due to the explicit concept of metadiscourse and the variety of its functions, such scholars as Burneikaitė (2008), Crismore (1993), Gil (2018), Hyland (2015), Tang (2021), Vande Kopple (2012) compiled a metadiscourse markers classification models used to study academic texts to simplify the process of the research in various aspects: rhetorical, semantic, pragmatic, cultural.

Several metadiscourse models prevail (Adel, Burneikaitė, Crismore, Gil, Hyland, Tang, Vande Kopple, etc.), in metadiscourse studies by both foreign and Lithuanian researchers. The definition of metadiscourse varies from Williams's broad understanding that it is 'writing about writing' to the even broader concept proposed by Vande Kopple that it is 'discourse about discourse' or even 'communication about communication.' Definitions of metadiscourse proposed by Swales, Crismore, Hyland, Halliday, Thompson, Ifantidou and other scholars are more specific, and more categorised. The writing process itself and the integrity of the text (Swales), the interaction between the text, the author and the reader (Crismore, Halliday, Hyland, Tse, Vande Kopple, etc.), intratextuality and intertextuality (Ifantidou, Thompson), reflexivity of the text or discourse (Adel, Gil, Jakobson, Mauranen, Salas, Toumi), and, as Tang defines, the link between metadiscourse, metalanguage and metacognition (Burneikaitė, 2008; Gil, 2018; Hyland, 2018; Salas, 2014; Tang, 2021; Toumi, 2009; Vande Kopple, 2012) are greatly emphasised. Scholars creating metadiscourse models follow a certain concept of metadiscourse, distinguish categories, and attribute metadiscourse markers to defined functions (Burneikaitė, Crismore, Gil, Hyland, Tang, Vande Kopple). Research in written academic discourse showed that one of the main functions of using metadiscourse is text structure. The author, using metadiscourse markers specific to the function of text organization (for example, transitions, endophoric, evidentials, code glosses, etc.), creates a coherent academic text, conveys information

intended for a certain audience, clarifies and explains information, helps to follow the text and understand the logical sequence of message expression (see Table 1).

Tab. 1: Functions of text-organising markers (referring to the models of Burneikaitė, Crismore, Gil, Hyland, Tang, Vande Kopple)

Category	Function	Markers	Examples
Text-organising markers (also known as *textual; interactive category; organisational metadiscourse; metatext)*	Connect parts of the text (sentences, paragraphs), expressed ideas; interpret connections in developing arguments; express semantic relation between main clauses; show how the text is structured (chapters, titles, etc.).	*transitions; text-connectives; textual; topicalisers, logical connectives; linking devices*	*Taigi; be to; taip pat / Thus; furthermore; also*
	Clarify, explain the information provided in the text; help readers understand intended meanings; paraphrase; reflect the author's predictions about the reader's initial knowledge.	*code glosses; activity connectives*	*Kitaip sakant; pavyzdžiui; t.y. / In other words; for example; i.e.*
	Specify the logical sequence of text organisation, label the stages of the text, indicate the peculiarities of discourse.	*frame markers; sequencers; discourse markers*	*Kitas; pirmiausia; šiame skyriuje / Next; first in this chapter*
	Point to different parts of the text; guide the reader through the text.	*endophoric; past conversation; future conversation; announcements; reminders; references to the text*	*1 lentelė; kaip minėta anksčiau; žr. 1 pav. / Table 1; as mentioned earlier; see Fig. 1*
	Refer to the information taken from other texts and other authors.	*evidentials; attributes; narrators*	*Pasak X; Y teigia / According to X; Y states*

Text-organising metadiscourse markers

As previously mentioned, the main function of the text-organising metadiscourse markers category (see Table 1) is to apply linguistic devices to create a lucid text, specify the logical sequence of text organisation, and guide the reader through the text. According to Hyland (2018), markers in this category help the author communicate one's interpretations, and purposes, and organise the text to meet the reader's expectations. Šinkūnienė (2014) also notes that the markers used by the author show the presumption of the reader's knowledge, rhetorical expectations, and requirements for the consistency of the text. Adel (2006), Gil (2018), Qin and Uccelli (2019), and Toumi (2009) also emphasise the importance of text-organising markers for the quality of the text, for creating logical connections of the separate text elements, and for appropriately referencing the used sources.

It is worth noting that scholars call this metadiscourse markers category differently (see Table 1), for instance, Hyland (2018) classifies those as *interactive metadiscourse dimension*, Burneikaitė (2008) names the term '*text-organizing*', Adel (2006), Gil (2018), Toumi (2009) calls this category *metatext*. Despite different terms defining the text-organising metadiscourse markers category, no significant differences were observed at the functional level. The term *text-organizing markers* is used in this study.

The research of the metadiscourse models of Burneikaitė, Crismore, Gil, Hyland, Tang and Vande Kopple (see Table 1) manifested that the metadiscourse markers assigned to the category of text-organising markers (*also known as textual; interactive category; organisational metadiscourse; metatext*) can be divided into:

1. Transition markers (*text-connectives; textual; topicalisers, logical connectives; linking devices)*, which are conjunctions and adverbs, the functions of which are to help the author create a logical text, connect parts of the text (sentences, paragraphs), express ideas, present arguments in the text and develop them, organise the text (chapters, titles, etc.). Furthermore, those linguistic elements are intended to help a reader to follow the author's message, comprehend the logic of text organisation, and pay attention to certain parts of the text (references to

chapter titles, certain segments of the text, separate parts of the text, etc.), recognise the discourse (Burneikaitė, 2008; Gil, 2018; Hyland, 2018; Šinkūnienė, 2014; Tang, 2021; Vande Kopple, 2012).

2. Code glosses (*activity connectives)* specify and explain the information presented in the text by supplementing it with other information, paraphrasing the existing one, referring to certain information in the text; defining, explaining terms or words, provide illustrations, and examples. These markers help the reader understand the author's intention, ideas, and argumentation; connect certain elements of the text, and also reflect the author's perception of the reader's initial knowledge (Burneikaitė, 2008; Gil, 2018; Guziurova, 2020; Hyland, 2018; Nausa Triana, 2017; Šinkūnienė, 2014; Vande Kopple, 2012).

3. Frame markers (*sequencers),* ***discourse markers*** **–** linguistic elements (mainly verbs, adjectives, adverbs) indicate the logical sequence and stages of the text organisation, ensure the consistency of the text and the discourse applied, also order and label arguments, ideas, point out the shift of the topics. Using these markers, the author guides the reader through the stages of the text and indicates the peculiarities of the discourse, thereby facilitating the comprehension of the text. (Hempel and Degand, 2006; Hyland, 2018; Hyland and Zou, 2020; Toumi, 2009).

4. Endophoric markers, ***references to the text*** (*past conversation; future conversation; announcements; reminders*) direct readers to certain places in the text. They help the reader to orientate himself in the text and connect separate segments of the text. These markers assist the author in indicating relevant, significant places in the text to the reader, and informing about certain things that will be described in other parts of the text. They also include linguistic elements pointing to the illustrations in the text (pictures, tables, diagrams, etc.) (Burneikaitė, 2008; Gil, 2018; Hyland, 2018; Šinkūnienė, 2014).

5. Evidential markers (*attributes; narrators*) provide references to the used information taken from other sources, emphasise the importance of the cited author or information. As a rule, the choice of markers in this category is determined by institutional rules, peculiarities of the discipline and/or discourse (Hyland, 2018; Šinkūnienė, 2014).

The analysis of this particular category of the metadiscourse markers is essential for the authors who aim to successfully create and organise the academic text, establish the relationship with the reader and meet the requirements of academic discourse. Even though, the use of text-organising metadiscourse markers in academic texts is an important factor, it is not extensively researched by scholars. Thus, the studies in the field of text-organising metadisocurse markers is of great value not only for scholars, but for students and translators as well.

2 Research methodology

The purpose of this work is to investigate the employment of text-organising markers as means of expressing the author's stance in academic texts in a cross-linguistic and cross-disciplinary aspects. This comparative study analyses scientific articles written in Lithuanian and English from the fields of technology and social sciences.

To carry out the research, the corpus-based technique was used. A specialised bilingual (Lithuanian and English) corpus was compiled in the *Sketchengine* platform from selected scientific articles in the fields of technology (mechanics, electrical engineering, electronics) and social sciences (economics) (see Table 2).

Tab. 2: Corpus characteristics

Corpus (LT)	Number of words	Corpus (EN)	Number of words
Scientific articles in the field of social sciences **(economics)** in **Lithuanian (LT_EKON)**	55,118	Scientific articles in the field of social sciences **(economics)** in **English (EN_EKON)**	55,720
Scientific articles in the field of technology **(mechanics, electrical engineering and electronics)** in **Lithuanian (LT_TECH)**	55,095	Scientific articles in the field of technology (mechanics, electrical engineering and electronics) in **English (EN_TECH)**	55,518
Total in **Lithuanian** :	**110,213**	Total in **English** :	**111,238**
Total: 221,451 words			

The peer-reviewed scientific articles published in 2018-2022 were used for corpus-based research (see the list of sources). When selecting the texts, an effort was made to equalise the total number of words in the corpus as it was noticed that scientific articles in the field of technology are significantly shorter than those in social sciences.

For quantitative survey, the absolute frequency usage of selected metadiscourse markers in the compiled bilingual corpus was calculated. A normalised frequency (cases in 1000 words) was also counted to ensure a reliable comparison. To calculate the normalised frequency, a formula was applied: the number of repetitions of the studied linguistic unit in the corpus is divided by the number of words in that particular corpus and multiplied by 1000 (Šinkūnienė, 2011). Several examples of text-organising metadiscourse markers were selected for the analysis (see Table 1) according to the previously described functions of the markers. The Lithuanian and English meanings of the selected examples of markers are the same in order to investigate not only the frequency usage of the selected linguistic devices but also the cross-linguistic and cross-disciplinary tendencies, similarities and differences.

Qualitative study is carried out by examining the features of the metadiscourse markers in academic texts identified in the corpus by studying their linguistic expressions, illustrated with examples from the analysed texts. The method of comparative qualitative research was applied to reveal cross-linguistic and cross-disciplinary similarities and differences of the studied metadiscourse markers.

3. Analysis

This part of the study presents the analysis the frequency usage and linguistic peculiarities of text-organising markers in scientific articles in the fields of mechanics, electrical engineering and electronics (TECH) and economics (EKON). As it was already mentioned, several examples of markers of this category in Lithuanian and their English equivalents were selected for research illustrating the peculiarities of the creation and organisation of a scientific text. In the first stage of the study, the usage frequency of the selected examples of text-organising markers in the compiled corpus was determined (see Table 3). The analysis revealed clear quantitative differences between markers used in the English and Lithuanian languages in the scientific articles in the fields of technology and economics.

Tab. 3: The absolute usage frequency of text-organising markers in the analysed scientific articles

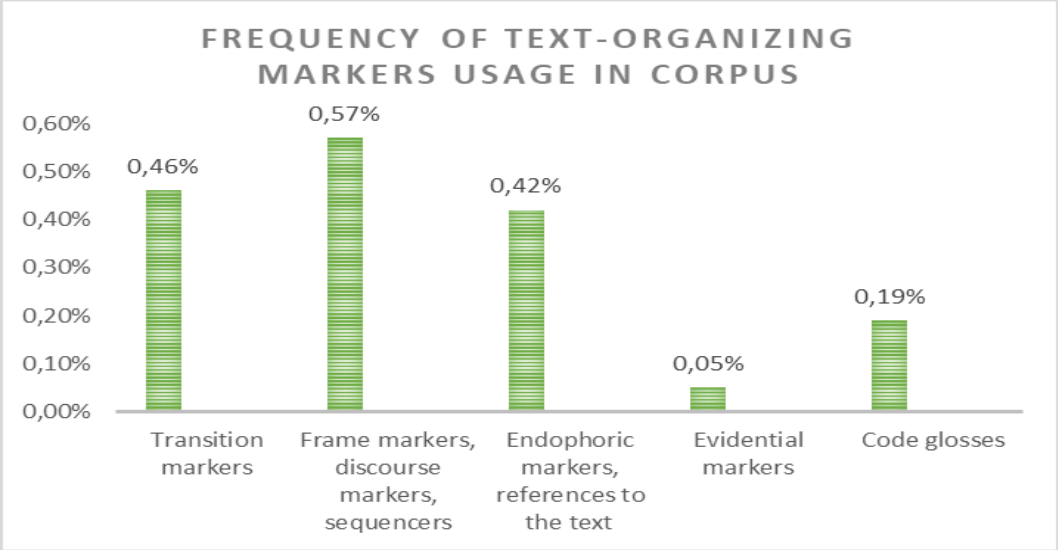
	Category	Markers in Lithuanian	Markers in English
Text-organizing markers category	**Transition markers**	**Taigi** (TECH – 30, EKON – 33) **Tačiau** (TECH – 69, EKON – 96)	**Thus** (TECH – 17, EKON – 24) **However** (TECH – 44, EKON – 42)
		Total: 228	**Total: 127**
	Frame markers, discourse markers; sequencers	**Apibendrinant** (TECH – 4, EKON – 9) **Šis straispnis / darbas** (TECH – 12, EKON – 1) **Analizė** (TECH – 22, EKON – 58) **Pirmiausia** (TECH – 2, EKON – 5) **Kitas** (TECH – 3, EKON – 4)	**In summary / in sum** (TECH – 1, EKON – 1) **This article / this work** (TECH – 23, EKON – 11) **The analysis of** (TECH – 17, EKON – 6) **Firstly / begin with** (TECH – 3, EKON – 1) **Next** (TECH – 3, EKON – 2)
		Total: 120	**Total: 68**
	Endophoric markers, references to the text	**(Kaip jau) minėta** (TECH – 1, EKON – 3) **Kitame skyriuje** (TECH – 1, EKON – 1) **Paveikslas / -e** (TECH – 220, EKON – 6)	**As noted** (TECH – 3, EKON – 1) **(In the) next section** (TECH – 3, EKON – 1) **Figure** (TECH – 8 3, EKON – 15)
		Total: 232	**Total: 106**
	Evidential markers	**Pasak** (TECH – 1, EKON – 13) **Teigia** (TECH – 2, EKON – 5)	**According to Y** (TECH – 3, EKON – 5) **Y claims / notes** (TECH – 4, EKON – 4)
		Total: 21	**Total: 16**
	Code glosses	**Kitaip tariant / sakant** (TECH – 6, EKON – 4) **Pavyzdžiui** (TECH – 17, EKON – 18)	**In other words** (TECH – 2, EKON – 5) **For instance / for example** (TECH – 30, EKON – 42)
		Total: 45	**Total: 79**

According to the data presented in Table 3, transition, frame markers, discourse markers and endophoric markers are employed much more often in the scientific articles written in Lithuanian than in English, while code glosses are more frequently used by the English-speaking authors. Evidential markers are quite rare in the academic texts written in both the Lithuanian and English languages. Thus, it can be stated that, from a cross-disciplinary perspective, the authors of the scientific articles in the field of economics apply transitions, discourse markers and code glosses while in the scientific articles on mechanics, electrical engineering, and electronics frame markers,

references to the text and code glosses are dominant. In both fields of the studied science, evidential markers, endophorics, sequencers are applied very rarely; frame markers are seldom used in the texts written in English.

The usage percentage of the selected examples of text-organising metadiscourse markers in the compiled corpus (i.e., out of 221,451 words) was analysed. As it can be seen in Figure 1, the frame markers, sequencers, and discourse makers make up 0.57 % of the compiled corpus, transition markers – 0.46 %, endophorics, references to the text – 0.42 %; code glossed (0.19 %) and evidential markers (0.05 %) make the smallest percentage of the corpus.

Fig. 1: Usage frequency of the text-organising metadiscourse markers in corpus



All the studied text-organising markers make only 1.69% of the compiled corpus, so it can be assumed that the researched linguistic devices are not a very significant means for the text creation and organisation in a quantitative aspect.

3.1 Transition markers in scientific articles

The analysis of the data indicated that transition metadiscourse markers are mostly used in the researched scientific articles. Statistically, no significant differences are observed between fields of study but quite substantial differences between languages emerged (see Table 4).

Tab. 4: Absolute and normalised usage frequency of transition markers

Transition markers	**Mechanics, electrical engineering and electronics (TECH)**		**Economics (*EKON*)**	
	Normalised frequency *(cases in 1000 words)*	**Absolute frequency**	**Normalised frequency *(cases in 1000 words)***	**Absolute frequency**
Taigi	30	0.54	33	0.60
Tačiau	69	1.25	96	1.74
Total (*LT_TECH-EKON*):	**99**	**1.79**	**129**	**2.34**
Thus	17	0.02	24	0.43
However	44	0.79	42	0.75
Total (*EN_TECH-EKON*):	**61**	**0.81**	**66**	**1.18**
Total:	**160**	**2.6**	**195**	**3.52**

After summarising the statistical data, it can be said that the expression of text coherence in the scientific articles written in Lithuanian and English differs. The transition markers in the articles vary depending on the field of science:

in the articles of economics, the conjunctions *'taigi'* and *'tačiau'* are used more often than in scientific articles in the fields of mechanics, electrical engineering and electronics (normalised frequency TECH – 1.79, EKON – 2.34). In articles written in English in the same fields of science, the English equivalents of the conjunctions *'taigi'* and *'tačiau', 'thus' and 'however'* are employed more often in scientific articles of economics (normalised frequency TECH - 0.81, EKON – 1.18). From the cross-linguistic aspect, a significant difference is noticeable, as Lithuanian transitions are used more often than their English equivalents (normalised frequency LT – 4.13, EN – 1.99). Thus, it can be assumed that both Lithuanian and English-speaking scholars apply more transition metadiscourse markers when writing scientific articles in economics than in the field of technology.

The analysis of the transition markers *'taigi', 'tačiau', 'thus' and 'however'* did not convey the peculiarities of linguistic usage in cross-linguistic and cross-subject aspects. The transitions *'taigi', 'tačiau', 'thus' and 'however* are employed to express effect, explanation, conclusion and assertion[1] and, according to Hyland (2010), create a semantic connection between the main linguistic elements in the text. Their function is to create a connection between sentences or parts of a sentence, perform a connective function (Hyland, 2018).

The examples below from the studied scientific articles illustrate this function of transition metadiscourse markers:

1) *Taikant optimizavimo realiuoju laiku metodą, informacija apie dominančius kriterijus atskleidžiama tuo metu, kai duomenys perduodami iš vieno įrenginio į kitą,* ***taigi*** *maršrutai kuriami dinamiškai, remiantis turima informacija. (TECH 28 LT)*
2) ***Taigi****, sumodeliuota lygtis gali būti taikoma norint išsiaiškinti, kaip keisis šalies šešėlinės ekonomikos mastas priklausomai nuo korupcijos ir skurdo lygio pokyčio, t. y. sumodeliuota lygtis gali būti taikoma norint atlikti šešėlinės ekonomikos masto prognozę. (EKON 11 LT)*
3) ***Thus****, specifically identifying a unique molecular feature, even with a high-resolution spectroscopic platform such as a single-molecule transistor, is difficult. (TECH 6 EN)*
4) *An earlier writer, defined standard of living as "the number of desires that take precedence in the individual choice over the effective desire for offspring" (Carver, 1924. p. 34),* ***thus*** *anticipating the basic idea of the demographic transition. (EKON 12 EN).*

The provided examples demonstrate that the authors use transition markers most probably to help the reader understand the sequence of ideas, confirm the points already discussed, the message expressed. Such a way of creating a text is peculiar to academic discourse, because in this way the author seeks to be understood when creating the text, thinks about the implied reader, the knowledge one has about the topic being written.

Other conjunctions explored in this category are *'tačiau' and 'however*. These conjunctions express the relationship of opposition and inconsistency between elements of the text[2], for example:

5) *Teoriškai ribinio dažnio paklaidą galima priartinti iki 0 %,* ***tačiau*** *tokios derinimo grandinės ir perjungiamų rezistorių arba kondensatorių matricų naudojamas integrinio grandyno plotas didėja geometrine progresija. (TECH 30 LT)*
6) *Onaran ir Obst (2016) pateikia įrodymų, kad euro zonos šalyse bendroji paklausa yra skatinama darbo užmokesčio.* ***Tačiau*** *ypač mažos, atviros ekonomikos šalys gali remtis pelno skatinama paklausa dėl bendrosios paklausos ypač svarbaus grynojo eksporto komponento, kadangi Europos šalys daugiausia prekiauja tarpusavyje. (EKON 13 LT)*
7) ***However****, for devices in which the molecules are sandwiched or bridge between two immobile electrodes, identifying device properties that are distinctly molecular, and that can be rationally altered via chemical synthetic modification of the molecular component, has been challenging. (TECH 6 EN)*
8) *Changes in coal prices,* ***however****, can move the position of the total factor income line in either direction. (EKON 1 EN).*

Hence, these conjunctions help the reader to understand the causal and contrastive relationships that the author creates (Hyland, 2018). In this way, the author indicates how the reader should interpret the information and arguments.

[1] Definitions from the electronic Lithuanian language (Internet access: http://www.lkz.lt/?zodis=taigi&id=26002590000) and Online Language Dictionaries *WordReference.com* (Access via the Internet: https://www.wordreference.com/definition/thus) dictionaries

[2] Definitions from the electronic Lithuanian dictionary (Access via internet: http://www.lkz.lt/?zodis=ta%C4%8Diau&id=26001810000) and Online Language Dictionary Collins (Access via the internet: https://www.collinsdictionary.com/dictionary/english/however)

As the given examples imply, there are no significant peculiarities between the explored fields of sciences and languages. The transitions chosen for the study in scientific articles perform the same functions typical to transition metadiscourse markers. They unveil that authors aim for the same goals, the same understanding of the organisation of the text (transitions are used both at the beginning and in the middle of the text).

Consequently, there are quantitative differences in the use of transition metadiscourse markers in Lithuanian and English scientific articles of mechanics, electrical engineering and electronics, and economics, but there is no difference in terms of functional use.

3.2 Frame markers, discourse markers, sequencers in scientific articles

Other examined metadiscourse markers are **frame markers, discourse markers and sequencers.** These markers are combined into one group as they perform the same functions, i.e. they indicate the logical sequence and stages of the organisation of the text, ensure the consistency of the text and the discourse employed, describe the actions performed, make it easier to follow thought, goals, summaries presented.

The results of the research revealed that in the analysed scientific articles, out of this group of markers, *discourse markers* are most frequently applied in both Lithuanian and English texts. Statistically, quite significant differences are observed in terms of language and the field of science (see Table 5).

Tab. 5: Absolute and normalised usage frequency of frame markers, discourse markers; sequencers

Frame markers	**Mechanics, electrical engineering and electronics (TECH)**		**Economics (*EKON*)**	
	Normalised frequency *(cases in 1000 words)*	**Absolute frequency**	**Normalised frequency *(cases in 1000 words)***	**Absolute frequency**
Apibendrinant (galima teigti)	4	0.07	9	0.16
Šis straispnis / darbas	12	0.21	1	0.02
Analizė	22	0.40	58	1.05
Pirmiausia	2	0.04	5	0.09
Kitas	3	0.05	4	0.07
Total (*LT_TECH-EKON*):	**43**	**0.77**	**77**	**1.39**
In summary / in sum	1	0.02	1	0.02
This article / this work	23	0.41	11	0.20
The analysis of	17	0.31	6	0.11
Firstly	3	0.05	1	0.02
Next	3	0.05	2	0.04
Total (*EN_TECH-EKON*):	**47**	**0.84**	**21**	**0.39**
Total:	**90**	**1.61**	**98**	**1.78**

As it can be seen from the data presented in Table 5, there is a statistically notable difference in the use of frame markers, discourse markers and sequencers. The results showed that markers of this group prevail in scientific articles of economics by Lithuanian authors (normalised frequency LT_EKON – 1.39) in comparison with English-speaking authors (normalised frequency EN_EKON – 0.39). Both Lithuanians and English authors of scientific articles in the fields of mechanics, electrical engineering and electronics employ these markers similarly (normalised frequency LT_TECH – 0.77, EN_TECH – 0.84). Therefore, the selected examples of these markers are used significantly more often in scientific articles written in Lithuanian (120 cases) than in English (68 cases) (see Table 5) and this group of markers is the third most frequently employed in overall corpus statistics.

The frame markers indicate discursive solutions for text organisation, mark certain text structuring elements, and ensure the coherence of the text. According to Hyland and Zou (2020), creating a consistent discourse authors take readers into account and aim to connect multiple elements of a text in a way that is understandable to the reader, and this is done through the use of frame markers. To illustrate the function, the Lithuanian marker *'apibendrinant (galima teigti)'* and its English equivalent *'in summary / in sum'* were chosen, the function of which is to draw a

conclusion from facts and cases[3]. Even though the function of this marker is considerably important for the organisation of an academic text, in the scientific articles analysed in this work, both the Lithuanian phrase *'apibendrinant (galima teigti)'* and the English equivalent *'in summary / in sum'* were used quite rarely (normalized frequency LT_TECH – 0.07, LT_EKON – 0.16, EN_TECH – 0.02, EN_EKON – 0.02). From the statistical data (see Table 5), it can be seen that this phrase is especially rare in the works of English-speaking authors (only 1 case was found), and this allows to make an assumption that it is not typical to provide conclusions at the end of chapters or highlight key aspects, make regular generalisations in academic texts in the fields of mechanics, electrical engineering, electronics, and economics. This can also be explained by the economy of language due to the requirements of scientific journals for the volume of published texts. In articles written in Lithuanian, especially economics, this marker is used more often (9 cases). The authors of scientific articles in mechanics, electrical engineering and electronics do not summarise their arguments and statements, because, as already mentioned, the articles in this field of science are very short and also richly illustrated with pictures, unlike articles in the field of economics.

The examples below illustrate the purposes of applying the researched markers as well as the function performed by *frame markers:*

9) ***Apibendrinant galima teigti, kad*** *nors kiekvienos klasės algoritmai yra pritaikomi, vis dėlto išmaniajai D2D komunikacijai DI labiausiai tinka biotechnologiniai algoritmai. (TECH 28 LT)*
10) ***Apibendrinant galima teigti, kad*** *šešėlinė ekonomika yra ekonominė veikla, kurios metu yra gaminamos prekės ar teikiamos paslaugos, tačiau visa tai vykdoma nesilaikant galiojančių teisės aktų bei jų reikalavimų, taip siekiama išvengti valstybėje esančių mokesčių ir reguliavimų. (EKON 11 LT)*
11) ***In summary****, we introduced the NiOx NFs as the HTLs for the planar carbon-based n-i-p PSCs. The overall efficiency of carbon-based PSC was enhanced by the inclusion of NiOx NF/NP HTL deposited on the perovskite layer. (TECH 1 EN)*
12) ***In sum****, these approaches are based on assumed economic incentives that come when community or individual rights of ownership or access to a fisheries resource or fishing ground have been clearly defined (Allison et al., 2012). (EKON 11 EN)*

All these examples show how the authors summarise the previously presented information and facts, thus helping the reader to understand the ideas expressed, the descriptions presented, statistical data and connect separate elements of the text.

Other examples of markers analysed in this group are *'šis straispnis / darbas', 'analizė', 'this article / this work', 'the analysis of'*, which are classified as *discourse markers*. Discourse markers connect the text with the discursive situation, create logical connections in the text, the relationship between the addresser and the addressee (Šinkūnienė, Jasionytė-Mikučionienė, Ruskan and Šolienė, 2020). So, the following examples of discourse markers illustrating the academic discourse, i.e. the reference to the text type (scientific article), data collection and organisation, were chosen for the study.

As Table 5 illustrates, discourse markers are the most abundant in the researched scientific articles (normalised frequency LT_TECH – 0.61, LT_EKON – 1.07, EN_TECH – 0.72, EN_TECH – 0.31) from the group of frame, discourse markers and sequencers. The analysed examples revealed that the noun *'analizė'* (58 cases) used by the Lithuanian authors of scientific articles on economics is the most common, while its English equivalent '*the analysis of*' (17 cases) is mostly employed in scientific articles of mechanics, electrical engineering and electronics. In the scientific articles of the same field, it is used more often (22 cases), while in English economics articles '*the analysis of*' is applied significantly less often (6 cases) compared to Lithuanian texts. The examples presented below dislose how the marker common to academic discourse is used in the scientific articles of the studied disciplines:

13) *This enabled the simulation of electron hole pair dissociation in crystalline pentacene F4TCNQ systems as well as* ***the analysis of*** *the doping dependent mobility and density of states. (TECH 9 EN)*
14) *For* ***the analysis of*** *spatial inequality, we combine the DMSP data for 2011 and 2012. (EKON 5 EN)*
15) *Gautų rezultatų* ***analizė*** *rodo, kad esant mažes nei dinamikai pasiekiamas geresnis Ex efektas, t. y. geresnis praktinis efektas, nors ηe ir ηExΣ rodikliai yra prastesni. (TECH 22 LT)*
16) *Atlikta teorinė* ***analizė*** *atskleidė, kad tvarus investavimas yra sėkmingos mėlynosios ekonomikos plėtros garantija. (EKON 4 LT)*

[3] Definitions from the electronic Lithuanian language dictionary (Internet access: apibendrinti| Lithuanian language dictionary (ekalba.lt) and Online Language Dictionary Collins (Internet access: In summary definition and meaning | Collins English Dictionary (collinsdictionary.com)

Therefore, in the scientific articles of economics, mechanics, electrical engineering and electronics the markers *'analizė', 'the analysis of'* are found in various places of the text, and the author's intention in this case is to draw the reader's attention to the elements important for the academic discourse (i.e. research methodology) and prevent the reader from forgetting the essential points mentioned in the text.

The situation is opposite with the other analysed sample *'šis straispnis / darbas', 'this article / this work'* (see Table 5). Most often, these markers are peculiar in English (23 cases) and Lithuanian (12 cases) scientific articles in the fields of mechanics, electrical engineering and electronics. Whereas, they make up less frequent cases (11 cases) in English scientific articles in economics and are extremely rare in Lithuanian texts of the same field (1 case). In academic texts, these markers help the author to organise the text by defining what will be done or recalling information that has already been presented. These elements of the text keep reminding the reader about the type of the text and discourse, for example:

17) ***Šiame straipsnyje*** *nagrinėsime Baltijos šalių oro uostų ekonomikos sektoriaus plėtrą, kuri betarpiškai susijusi su šių šalių ekonomikos augimu. (EKON 2 LT)*
18) ***In this article****, we describe two stand-alone devices, JetLid and TipWaster, built in this manner. (TECH 7 EN)*
19) ***Šiame darbe*** *pristatytas didelės galios mikrosekundinių impulsų generatorius, sukurtas Fizinių ir technologijos mokslų centro Elektroninių sistemų laboratorijoje. Jis taikomas bioelektrocheminiams tyrimams. (TECH 20 LT)*
20) *Getting more specific, the biophysical model of Great Britain, that was built upon* ***in this work****, has nine parameters (Kennedy, 2021); these are indicative of opportunities that the political economy may influence (EKON 1 EN)*

This group of markers also includes *sequencers*, which make the text cohesive, present the sequence of actions, and organise ideas. Sequencers are divided into spatial, temporal and numerical *(*Hempel, Degand, 2008). The following examples of sequencers were chosen in this study: "*pirmiausia", "kitas", "firstly", "next"*. *'Pirmiausia'* and *'firstly'* are assigned to numerical sequencers, and *'kitas'* and *'next'* to temporal sequencers. According to Hempel and Degand (2008), the author creates a logical, clear and easy-to-understand text by using numbering sequencers at the beginning of each new phrase, message, argument, and temporal markers create a chronological sequence of narration.

Quantitative analysis of these markers showed that these linguistic devices are not frequent in the articles of mechanics, electrical engineering and electronics (normalised frequency LT_TECH – 0.09, EN_TECH – 0.08) and economics (normalised frequency LT_EKON – 0.16, EN_EKON – 0.06) (see Table 5). It can be assumed that in terms of cross-linguistic and cross-disciplinary aspects there is a common tendency not to indicate the sequence of text, actions and message to the reader, perhaps due to the nature of the text being created when there is no need to describe the sequence or due to the economy of the language.

Numeric sequencers *'pirmiausia'* and *'firstly'* in the scientific articles of economics written by Lithuanian authors (5 cases) are found more often than in the texts written by English authors (1 case). The analysed markers are rarely used by both Lithuanian and English authors in the field of technology (LT_TECH – 2, EN_TECH – 3 cases). In accordance with the examples below, there are no significant qualitative differences in usage, as the researched sequencers are usually employed at the beginning of the message to inform the reader about the course of action:

21) ***Pirmiausia*** *buvo atlikti reaktorių srovių, valdomų tiristoriais, tyrimai esant įvairių tiristorių atidarymo momentams. (TECH 16 LT)*
22) *Dauguma mokslininkų, savo tyrimuose tirdami funkcinio pajamų pasiskirstymo kitimo poveikį bendrajai paklausai,* ***pirmiausia*** *nustato, ar vidaus paklausa yra skatinama darbo užmokesčio ar pelno. (EKON 13 LT)*
23) ***Firstly****, we optimize the performance for NiOx-based devices for different thicknesses of NiOx HTL by varying the spin-coating speed from 2000 to 4000 r.p.m. As shown in supporting information Table S1, devices with NPs and NFs deposited at 3000 r.p.m. recorded the best PCE due to the impressive Jsc and FF. (TECH 1 EN)*
24) ***Firstly****, we explain why marketbased trajectories of change put forward as part of the Blue Economy pose risks to the benefits that SSF provide to society. (EKON 11 EN)*

The markers of the temporal sequencers *'kitas'* and *'next'* are applied similarly in both analysed scientific fields and languages from the quantitative (see Table 5) and qualitative perspectives. The examples below reveal that by using these markers, the author tells the reader the sequence of actions in time perspective, thus creating a coherent text:

25) ***Kitas*** *bandymas buvo kietumo matavimas siūlėje. Kietumo matavimai, atsižvelgiant į standartą LST EN ISO 9015–1:2001, atliekami siūlėje, terminio poveikio srityje ir pagrindiniame metale (7 paveikslas). (TECH 29 LT)*
26) ***Kitas*** *ribojantis faktorius yra respondentų subjektyvumas. (EKON 8 LT)*

27) *Exploring how these spatially dependent interfacial properties affect electrolyte species is the focus of the **next** section. 3. (TECH 3 EN)*
28) *Three further quantities are **next** required, as I move into Political Economy and apply the extended model from Section 2. (EKON 1 EN)*

Summarising the tendencies in the employment of **frame markers**, **discourse markers** and **sequencers**, it can be observed that there are cross-linguistic and cross-disciplinary similarities, i.e. discourse markers are the most frequent and frame markers and sequencers – the most rare. This could be explained by the peculiarities of writing a scientific article, since this type of text is generally not large in volume (especially the texts in the field of technology). The specificity of frame markers and sequencers is closer to longer texts, so the authors of scientific articles do not choose to describe the sequence or processes extensively, therefore do not use these markers. Meanwhile, discourse markers are very specific to academic texts, therefore in the analysed cases, their frequent use is observed.

3.3 Endophoric markers, references to the text in scientific articles

Endophoric markers and references to the text are vital for the structuring of the text, as, according to Šinkūnienė (2014), they help the author to direct readers to certain places in the text, indicate relevant, important places in the text, and inform about certain things that will be described in other parts of the text. They also orientate the reader in the text and connect separate segments of the text. These markers also include linguistic elements that point to the illustrations in the text. As the quantitative analysis presented in Table 6 shows, there is a clear cross-disciplinary difference in the researched scientific fields: Lithuanian and English-speaking authors of scientific articles in mechanics, electrical engineering and electronics apply endophoric markers and references to the text significantly more than authors of scientific articles in the field of economics (normalised frequency LT_TECH – 4.03, EN_TECH – 1.6, LT_EKON – 0.18, EN_EKON – 0.34). These results reveal the peculiarity of the use of linguistic devices in the field of technologies as it was noticed that there are more pictures, tables, and formulas in the texts of mechanics, electrical engineering and electronics than in the economics articles, so it is natural for the authors to mention those in one or the other part of the text.

Tab. 6: Absolute and normalised usage frequency of endophoric markers and references to the text

Endophoric markers, references to the text	**Mechanics, electrical engineering and electronics (TECH)**		**Economics (*EKON*)**	
	Normalised frequency *(cases in 1000 words)*	**Absolute frequency**	**Normalised frequency *(cases in 1000 words)***	**Absolute frequency**
(Kaip jau) minėta	1	0.02	3	0.05
Kitame skyriuje	1	0.02	1	0.02
Paveikslas / -e	220	3.99	6	0.11
Total (LT_TECH-EKON):	**222**	**4.03**	**10**	**0.18**
As noted	3	0.05	1	0.02
(In the) next section	3	0.05	3	0.05
Figure	83	1.50	15	0.27
Total (*EN_TECH-EKON*):	**89**	**1.6**	**19**	**0.34**
Total:	**311**	**5.63**	**29**	**0.52**

The usage frequency of the marker '*paveiklsas*' and its English equivalent '*figure*' perfectly illustrates this phenomenon. In the scientific articles on mechanics, electrical engineering and electronics written by Lithuanian authors, 220 cases are found meanwhile in English only 83 (see Table 6). It is worth mentioning that even in the shorter articles written in Lithuanian, the noun '*paveikslas*' is used significantly more often than the marker '*figure*' in the longer English articles, so a cross-linguistic difference can also be highlighted. Not mentioning the fact, references to pictures are very rare in the scientific articles of economics, probably it could be attributed to the peculiarity of writing academic texts in this discipline. Nonetheless, these markers are employed similarly in terms

of cross-linguistic and cross-disciplinary aspects as the marker performs the same function – draws the reader's attention to the illustrations in the text. There it should be noted that in English the reference to the picture is written in a capital letter, whereas in Lithuanian – a small letter. But the marker is applied in various places of the scientific article written in Lithuanian and English:

29) *Iš 3 cm aukščio konstrukcijų rezultatų matyti, kad visuose dažniuose kameroje su didžiausio skersmens kabelių konstrukcijomis aidėjimo trukmė yra ilgesnė už trukmę naudojant mažesnių skersmenų kabelių konstrukcijas (10* ***paveikslas****). (TECH 11 LT)*
30) *Išnagrinėjus mokslinę literatūrą nustatyta, kad nors skirtingi autoriai naudoja skirtingus terminus, bet iš esmės egzistuoja keturi pagrindiniai sutelktinio finansavimo modeliai, apibendrinami 1* ***paveiksle*** *ir plačiau aptariami toliau pateikiamoje diskusijoje. (EKON 14 LT)*
31) *As seen in* ***Figure*** *2(b) the surface geometry of the metal electrode is clearly evident from the density profile of the adsorbed water monolayer, and the specific pattern of vacancies persist over the nanosecond averaging. (TECH 3 EN)*
32) *The notion of a singular water supply as monitored through national representative surveys used for global monitoring simplifies the complex choices people make on a daily basis (****Figure*** *1). (EKON 8 EN)*

Other analysed examples *'kitame skyriuje'* and *'(in the) next section'* are extremely rare in the articles of Lithuanian authors (only 1 case was found in the analysed scientific articles), while they are applied in the texts of English-speaking authors (3 cases were found in each studied discipline) a little more often. These markers help the author to arrange the text consistently, inform the reader about the essential points in the text, connect separate segments of the text and get an impression of what information will be provided in the text. On the other hand, personal pronouns often used in this linguistic device establishe a relationship with the reader and allow the reader to identify himself with the author:

33) ***Kitame skyriuje*** *aptarsime siūlomą 2D Vernier laikinio skaitmeninio keitiklio struktūrą, kurios pagrindas yra žiediniai generatoriai. (TECH 7 LT)*
34) *Tyrime atliekami stacionarumo, priežastinio ryšio, tarpusavio priklausomumo bei ryšio stiprumo, kointegruotumo ir poveikio nustatymo testai, jie detaliai aptariami* ***kitame skyriuje****. (EKON 14 LT)*
35) *However, as described* ***in the next section****, researchers are developing a number of new methods that may eventually permit the deposition of top electrode materials onto less-than-perfect molecular monolayers. (TECH 6 EN)*
36) *We show* ***in Section 5.2*** *below that going in the opposite direction, by disaggregating to the third sub-national level (counties and districts) increases the gap in the predictive performance of DMSP and VIIRS. (EKON 5 EN)*

In order to remind the reader of the things already described and discussed, the author usually employs such expressions of reference to the text as *'"(Kaip jau) minėta', 'as noted above'*. But in this study, the extremely rare usage of these markers is observed cross-linguistically and cross-disciplinary (see Table 6). This marker is usually applied at the beginning of a sentence to draw the reader's attention. The following are the cases found in the analysed scientific articles:

37) ***Kaip minėta****, daugiasluoksnis spausdinimas yra labai patrauklus ne tik dėl galimybės išgauti sudėtingas maisto formas, bet gali būti taikomas ir naujiems maisto produktams kurti, siekiant išbandyti įvairius maisto ingredientų derinius arba pritaikyti mitybą individualiems poreikiams. (TECH 4 LT)*
38) ***Kaip jau buvo minėta****, tyrimas buvo atliktas 2018 m. lapkričio–gruodžio mėnesiais, naudojantis Eurostat duomenų bazėje pateikta statistika. (EKON 11 LT)*
39) ***As noted above****, the exact shape and position of the curve (and characteristics of the optimal model) will depend on the complexity of the physical situation being modelled. (TECH 5 EN)*
40) ***As noted above****, Indonesia is also one of the few developing countries with reliable second level sub-national GDP data that we can use as our benchmark. (EKON 5 EN)*

In the research of the usage of endophoric markers and references to the text in scientific articles on technologies and economics written in Lithuanian and English, an apparent tendency is revealed, i.e. the authors of scientific articles written in the Lithuanian language in the field of technology apply references to certain parts of the text more often, which most probably contributes to structuring the text according to disciplinary requirements.

3.4 Evidential markers in scientific articles

Evidential markers provide references to the information taken from other sources. These markers are typical for the creation of a scientific text, as authors often examine the works, studies and research of other authors and

rely on them in the academic texts they create. As a rule, the specificity of employing these markers is determined by institutional, disciplinary, and publication requirements, or the author's individual choice of citation style (APA, MLA, etc.). Qualitatively, clear cross-linguistic and cross-disciplinary differences are not observed in the analysed scientific articles of mechanics, electrical engineering and electronics as well as economics, as the cited source is usually indicated in parentheses anywhere in the sentence, for example:

41) *Šiame keitiklyje aptinkama didelių parazitinio sklaidos srauto magnetinėje sistemoje reiškinių (angl. leakage inductance)* ***(Ouyang ir Zhang, 2015; Leuenberger ir Biela, 2015)****, kurie raktų komutacijos metu kuria keitiklio galios grandinėse viršįtampius (angl. voltage spikes). (TECH 12 LT)*
42) *Savo tyrimuose nustatė, kad kintantys makroekonomiai rodikliai daro įtaką keleivių skaičiui oro uostuose ir bendram aviacijos užimtumui* ***(Chaouk et al., 2020)****. (EKON 12 LT)*
43) *This is illustrated by an uptick in global ocean-focused conferences that have previously framed conservation as the leading agenda, which now emphasize a focus on the "Blue Economy"* ***(Bennett, 2018)****. (EKON 11 EN)*
44) ***Accordingly****, the direct approach is more commonly applied for geotechnical back analysis* ***(Gioda and Maier, 1980; Cividini et al., 1981; Sakurai and Takeuchi, 1983)****. (TECH 5 EN)*

Quantitative study of the selected evidential markers *'pasak', 'teigia', 'according to Y' and 'Y claims / notes'* are not frequently used in scientific articles in the field of economics, mechanics, electrical engineering and electronics (see Table 7) (normalised frequency LT_TECH – 0.06, EN_TECH – 0.84, LT_EKON – 0.33, EN_EKON – 0.16), but they exceed obvious cross-linguistic and cross-disciplinary differences. As Table 10 illustrates, analysed markers are most regularly used by English-speaking authors writing on economics and Lithuanian authors in the articles of mechanics, electrical engineering and electronics.

Tab. 7: Absolute and normalised usage frequency of evidential markers

Evidential markers	**Mechanics, electrical engineering and electronics (TECH)**		**Economics (*EKON*)**	
	Normalised frequency *(cases in 1000 words)*	**Absolute frequency**	**Normalised frequency *(cases in 1000 words)***	**Absolute frequency**
Pasak	1	0.02	13	0.24
Teigia	2	0.04	5	0.09
Total (LT_TECH-EKON):	**3**	**0.06**	**18**	**0.33**
According to Y	3	0.05	5	0.09
Y claims / notes	4	0.79	4	0.07
Total (*EN_TECH-EKON*):	**7**	**0.84**	**9**	**0.16**
Total:	**10**	**0.9**	**27**	**0.49**

Qualitative analysis showed no differences, as both Lithuanian and English authors use these markers as an integrated part of the text when referring to the cited source, for example:

45) ***Pasak S. Girdzijausko, D. Štreimikienės ir R. Mackevičiaus (2009: 76)****, egzistuoja ekonominis ciklas – tam tikras svyravimas, pasireiškiantis bendroje ekonominėje šalies veikloje. (EKON 6 LT)*
46) *Mokslininkai* ***teigia****, kad 3D spausdinimo technologijos greitai bus sujungtos į 3D spausdinimo ekosistemą, kuri apims maisto, vaistų, organų ir audinių spausdinimą. (TECH 4 LT)*
47) ***According to*** *the VIIRS data, the average Kota emits more than twice as much light as the average Kabupaten but with DMSP data Kabupaten seem to produce about 20% more light than Kota (at the means) (EKON 5 EN)*
48) ***As noted by Potyondy and Cundall (2004)****, one of the challenges with calibrating BPM simulations to laboratory data is uncertainty with respect to which indicators from data should be used for the purposes of calibration. (TECH 5 EN)*

Thus, evidential markers are a particularly unique means of text structuring when creating a scientific text, because the analysis of the texts shows that references to other sources are very often employed by both Lithuanian and English-speaking authors in both researched fields of science. However, it is obvious that the reference to another source is less often used, especially by Lithuanian authors of mechanics, electrical engineering and electronics, as a homogeneous part of the sentence applying markers such as '*pasak', 'teigia', 'according to Y'* and

'Y claims/notes', even though creating the text by the use of these markers would be more reminiscent of a descriptive style, which is likely to be more acceptable and understandable to the reader.

3.5 Code glosses in scientific articles

Code glossed in academic texts specify, explain or expand the ideas expressed (Šinkūnienė, 2014). They also help the reader to understand the linguistic elements, words, and terms in the text (Vande Kopple, 2012). Hyland (2018) states that the use of code glosses reveals the author's intention to explain, successfully convey information to the reader as well as to substantiate his claims, and convince the reader.

The studied code glosses examples *'kitaip tariant', 'pavyzdžiui', 'in other words' and 'for instance/for example'* create links between separate parts of the text, explain and help the reader to better understand the text. Quantitative analysis (see Table 8) revealed that English-speaking authors of scientific articles prefer code glosses (normalised frequency EN_TECH – 0.59, EN_EKON – 0.84), while Lithuanian authors do not favour them (normalised frequency LT_TECH – 0.42, LT_EKON – 0.40). The statistical data prove both cross-linguistic and cross-disciplinary differences in the use of code glosses (in particular in the field of economics), as English-speaking authors prefer code glosses almost twice as often as Lithuanian authors. In the field of mechanics, electrical engineering and electronics, significant cross-linguistic and cross-disciplinary changes are not observed. Thus, in scientific articles written in English, the authors try to explain their statements, and the information provided, thus facilitating the reader's understanding of the text.

Tab. 8: Absolute and normalised usage frequency of code glosses

Code glosses	**Mechanics, electrical engineering and electronics (TECH)**		**Economics (*EKON*)**	
	Normalised frequency *(cases in 1000 words)*	**Absolute frequency**	**Normalised frequency *(cases in 1000 words)***	**Absolute frequency**
Kitaip tariant / sakant	6	0.11	4	0.07
Pavyzdžiui	17	0.31	18	0.33
Total (LT_TECH-EKON):	**23**	**0.42**	**22**	**0.40**
In other words	2	0.05	5	0.09
For instance / for example	30	0.54	42	0.75
Total (*EN_TECH-EKON*):	**32**	**0.59**	**47**	**0.84**
Total:	**55**	**1.01**	**69**	**1.24**

The function of code glosses is perfectly illustrated by examples from the analysed scientific articles, when the author seeks to explain his/her expressed ideas by paraphrasing the statements, clarify those parts of the text that may be unclear to the reader or cause some doubts. The following markers *'kitaip tariant', 'in other words' are* employed for this purpose:

49) ***Kitaip sakant****, modeliuojami procesoriai dažnai neturi čia paminėtos programinės įrangos, todėl nėra tęstinumo. (TECH 19 LT)*

50) Remiantis žemiau pateikta formule, apskaičiuotos visos sandaugos ir jų sumos. ***Kitaip tariant*** *Sj – sandaugų suma (EKON 5 LT)*

51) ***In other words****, during a trial-and-error back analysis process, a researcher may be confronted with the dilemma as to whether any model-data mismatch is due to an imperfect calibration, or a limitation of the modelling method or model representation. (TECH 5 EN)*

52) Changes in coal prices, however, can move the position of the total factor income line in either direction. ***In other words****, the price of energy influences the distribution of total income between the sectors. (EKON 1 EN)*

In order to explain and expand the idea, the authors use markers such as *'pavyzdžiui'* and *'for instance / for example':*

53) ***Pavyzdžiui****, jei vėlinimo liniją sudarančių elementų vėlinimo trukmės lygios 3Δ ir 5Δ, 1D Vernier LSK mažiausia išmatuojama laiko trukmė būtų lygi 5Δ – 3Δ = 2Δ, o 2D Vernier LSK – Δ. (TECH 7 LT)*

54) Skolintojai gali gauti didesnę grąžą lyginat su kitomis investavimo galimybėmis, ***pavyzdžiui****, įmonių vertybiniai popieriai, banko indėliai (Emekter, Tu, Jirasakuldech ir Lu, 2015). (EKON 14 LT)*

55) *In stand-alone devices, a 3D printed housing might be designed to hold input sensors, a microcontroller, and output peripherals in a form factor customized to that particular application.* ***For instance****, it might be an add-on to an existing device to create new functionality. (TECH 7 EN)*

56) *If,* ***for example****, the price of coal was higher, then all else being unchanged, the profit-wage relationship for coal-mining would move outwards. This would be compensated by the profit-wage relationships for construction and for the production of goods and services moving inwards (EKON 1 EN)*

Qualitative analysis of the markers analysed demonstrated that code glosses in scientific articles written in Lithuanian perform the same functions as in academic texts in English. Also, they are used similarly: phrases are separated by commas in various parts of the text, sentence.

Conclusions

After analysing the application tendencies of metadiscourse markers in academic texts, it can be stated that different concepts of metadiscourse prevail, based on which different metadiscourse models are created, categories of markers are distinguished, and functions are assigned. Crismore, Hyland, and Vande Kopple's metadiscourse models, which include markers of the categories of text creation, its organisation and the author's stnance, are commonly used for the analysis of academic texts. The survey of metadiscourse studies revealed that the universality of academic discourse prevails. Not only do scientific articles written by authors of the same genre, but different languages, cultures and disciplines have differences but also similarities in the frequency and functional aspects of the marker application. This is also confirmed by this study, during which the correlation of the frequency of use of metadiscourse markers with a specific language and discipline, as well as individual characteristics, was determined.

Summarizing the results of the usage of text-organising metadiscourse markers in scientific articles, it can be affirmed that transition markers, endophoric markers and references to the text, which are specific to the writing of the academic text, are the most common. Whereas evidential markers are the least preferred, although they are particularly relevant for the structure of an academic text, as they are intended to refer to the works of other authors cited in the text. Quantitative cross-linguistic and cross-disciplinary differences emerged during the study, but no qualitative differences in the employment of markers were observed. From the cross-linguistic and cross-disciplinary perspectives, the use of frame markers, discourse markers and sequencers in the scientific articles in the field of economics is significantly different. Referring to the cross-disciplinary aspect, the most obvious difference can be seen in the use of endophoric markers and references to the text applied by Lithuanian authors. In terms of the cross-linguistic point of view, the use of evidential markers in the scientific articles of mechanics, electrical engineering and electronics is identified. Similarities in the application of markers are also observed: code glosses are employed with a similar frequency in both cross-linguistic and cross-disciplinary aspects, while frame markers, discourse markers and sequencers are used similarly by both Lithuanian and English-speaking authors in the fields of mechanics, electrical engineering and electronics. The analysed examples of text-organising markers demonstrated the features typical for the creation of a scientific article (connection of ideas, logical sequence, consistency, references to the information provided in the text or to the works of other authors, explanation, grasping attention, etc.) and perform functions that do not differ in cross-linguistic and cross-disciplinary aspects.

The outcomes of the conducted comparative study indicated that the authors of English and Lithuanian scientific articles in the fields of technology and economics tend to create a coherent text, therefore transition, endophoric markers and reference to the text are often preferred. The more frequently used evidential markers, which are intended to refer to the works of other authors, show the individual choices of the authors in the field of technology, determined by the specificity of the discipline or the requirements of the publication regarding the scope and structure of the text. The results of the conducted quantitative research conveyed that in the scientific articles on technology and economics written in English and Lithuanian, there were significantly more text-organising markers in the articles written in Lithuanian. In terms of cross-disciplinary aspects, the authors in the field of economics use text-organising markers more often than authors in the field of technology, which means that disciplinary differences dominate. The researched examples of markers disclosed the qualitative similarities of the performed functions in cross-linguistic and cross-disciplinary aspects because markers are employed to perform the same functions, and pursue the same goals, and the same perception of text organisation. No qualitative differences were detected.

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