

A bridge between legislator and technologist - Formalization in SBVR for improved quality and understanding of legal rules

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Abstract. The paper reports on how the two separate worlds of legislator and IT-technologist can be bridged through the formalization of legal rules with SBVR. The legislator can use SBVR to transform legal rules expressed in natural language to legal rules expressed in controlled natural language. During the transformation, impreciseness and inconsistency in the law formulation may be revealed and entail improved quality of the law formulation. The institutions implementing the legal rules can use SBVR documents published by the legislator to save time in their analyzing phase and even to automate the transformation from vocabulary and rules in SBVR to vocabulary and rules in a business rules management system (BRMS). The more institutions that are affected by the same legislation the more time and effort will be saved.

Keywords: SBVR, legal rules, legislator, interpreting, semantic ontology

1 Introduction

This paper reports on the conclusions of a study on formalization of legal rules with SBVR [Johnsen 2010]. Business rules are built on internal business rules, external business rules according to branch standards and legislation. Legislation consists of laws and regulations and represents legal rules the institutions are obligated to implement. Legal rules can be concrete, complex and detailed and be obvious candidates for automated proceeding by IT-solutions. Some laws and regulations affect several institutions. Each of them has to analyze and implement the legislation into their IT-systems. This paper is about using [OMG 2008] Semantics of Business Vocabulary and Business Rule (SBVR) on this kind of legislation.

The main idea of the study reported here is to let the legislator who is the author of the legislation, do the interpretation of the legislation. In other word, let the legislator use SBVR to transform from natural language to controlled natural language. SBVR represent a basic non-commercial standard for transforming natural language to

formal language, and you do not have to be an IT-technologist to use it. By transferring the interpretation from the institutions to the legislator, each of the institutions implementing the law would save time. In addition the SBVR modeling could reveal impreciseness in the law text that should be revised. The legislator is the one who knows the legal content of the law text and is in position to adjust it and in this way reduce need for later adjustments. The laws and regulations should still exist in natural language, but be supplemented with the SBVR formulations, as a kind of approved guidance.

Section 2 describes the case, section 3 summarizes findings from the case using examples in SBVR and section 4 is a suggestion for future work.

2 Case description

To examine whether laws could be formed in a way making them more consistent and easier to implement in IT-solutions, and whether SBVR could be used to do it, SBVR was tried to model three cases from the law and the findings evaluated.

All cases were selected from Norwegian Law [LovData] the “National Insurance Act of 28 February 1997”:

Case 1: § 2 ”Membership in the National Insurance” modeled into a SBVR document with vocabulary and a rule set containing 17 rules.

Case 2: § 3-34 - § 3-26 with supplementary regulation § 1 - § 4 ”Supplement for spouse and supplement for children” modeled into a SBVR document with vocabulary and a rule set containing 17 rules.

Case 3: § 19-8 - § 19-9 ”Lowest pensionlevel” modeled into a SBVR document with vocabulary and a rule set containing 7 rules.

The cases pay special attention on legislation regulating the insurance- and pension field which is a branch with complicated rules which applies to both governmental and private institutions. However the same principles could be applied to legislation in other rule-intensive areas as custom services, tax services, welfare administration, public road services and so on.

Legal rules convenient for the kind of reformulation described in this paper, have two characteristics:

- It contains rules to decide if a person fill the requirement to receive a benefit or pay a tax

- It contains rules to calculate size of the benefit or the payment

Extracting rules from legislation is often tedious work, whoever does it. This is familiar to IT people. It is often about structuring details, so also here. The case descriptions had to be quite detailed to show how the law content could be converted to SBVR compliant vocabulary and rules. The findings in section 3 are illustrated with examples from the first of the three cases which concerns membership in the National Insurance.

To our knowledge SBVR has not been used on texts written in Norwegian before, so the modeling started with defining SBVR Structured Norwegian. In this paper, however, the examples are translated into SBVR Structured English. Source is used to connect the rule to corresponding subsection of the act. One sentence in the act, may give several rules.

3 Evaluation of findings from using SBVR to transform legal rules

Citations from the law are in frames and refer to the “National Insurance Act of 28 February 1997”. The examples are picked among more similar examples.

As an introduction to the findings, I briefly draw up the main principle for membership in the National Insurance in Norway: To be entitled to receive benefits in accordance with the National Insurance Act, one has to be or to have been a member in the national insurance. Some benefits require that you are a member at the time a situation, which can invoke the benefits occur. For other benefits it is enough to have been a member of the National Insurance. The size of the benefits is often proportional to the duration of the membership.

The findings can be grouped in three divisions:

3.1 Findings related to clarify and improve the law text

3.1.1 Reveal unambiguous formulations

Legal rules can be understood in different ways and be a basis for alternative rules.
Example:

§ 2–1. People who are Norwegian residents, subsection 2
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“Norwegian resident is defined as one who is staying in Norway, when the stay is intended to last or has surpassed 12 months. A person who moves to Norway is considered a resident from the date of arrival.”

The formulation “is intended to last” is imprecise. The formulation considers something that could happen in the future. Should a stay that was intended to last at least 12 months, but in the end lasted less than 12 months, be a period in a membership in the National Insurance or not? The formulation is ambiguous, and two alternative rules could be possible:

Rule alternative 1: The residence in Norway doesn’t give any temporary membership in the National Insurance:

If a person moves to Norway and has residence permit and the resident is intended to last at least 12 months and the resident lasts less than 12 months, then the resident do not gives a member period in membership in the national insurance

Source: § 2-1 subsection 2

Rule alternative 2: The residence in Norway gives a membership in the National Insurance even if the stay lasted less than 12 months

If a person moves to Norway and has residence permit and the resident is intended to last at least 12 months and the resident lasts less than 12 months, then the resident gives a member period in membership in the national insurance with start date equal date of arrival and end date equal date of departure

Source: § 2-1 subsection 2

If the legal rules were supplemented with rules formulated with SBVR, one of the alternatives would be chosen and thereby eliminating any doubt about what was the correct interpretation.

3.1.2 Reveal and clarify imprecise formulations

Parts of the law text need to be made more precise before it is possible to deduce rules from it. Often definitions in the vocabulary contribute to the necessary preciseness.

Example:

§ 2–1. People who are Norwegian residents, subsection 4 second part

“However, this does not apply if the person concerned has stayed or will be staying abroad for more than six months per year for two or more consecutive years.”

It is difficult to understand the exact meaning of “per year for two or more consecutive years” which could be interpreted in two different ways:

- a) one year starts at date of departure and lasts 12 months from this date
- b) one year is a calendar year

In the vocabulary both year and calendar year were defined:

year

Definition: period with duration 12 months
Supporting fact types: year has start date
year has end date
year has duration 12 months

calendar year

Definition: year in accordance with the Christian era
Supporting fact types: calendar year starts 01 January
calendar year ends 31 December
calendar year has duration 12 months

In the rule beneath year as defined in the vocabulary is chosen and a necessary preciseness is achieved:

If a member of the national insurance on actual date has stayed at least 6 months abroad each year for 2 or more consecutive years, then the person is not member of the national insurance from actual date

Source: § 2-1 subsection 4 second part

3.1.3 Identify certain kind of formulations to avoid

Parts of the law text embrace two different time aspects i.e. past and future in the same formulation. This is an example of a kind of formulation that should be avoided in laws dealing with detailed regulations because it makes exact formulation difficult. Formulations like these should be placed on some sort of ‘black-list’ collecting no-wanted kinds of formulations.

Example (same law text as in example A.2):

§ 2–1. People who are Norwegian residents, subsection 4 second part

“However, this does not apply if the person concerned has stayed or will be staying abroad for more than six months per year for two or more consecutive years.”

The law formulation hides two different circumstances/conditions: One about the future and one about the past.

Rule a. refers to the future: “However, this does not apply if the person concerned **will be staying** abroad for more than six months a year for two or more consecutive years.”:

Rule a.

If a member of the national insurance moves from **Norway** and will be staying at least **6** months abroad each year for **2** or more consecutive years, then the person is not member of the national insurance from date of departure

Source: § 2-1 subsection 4 second part

Rule b. refers to the past: “However, this does not apply if the person concerned **has stayed** abroad for more than six months a year for two or more consecutive years.”:

Rule b.

If a member of the national insurance on actual date has stayed at least **6** months abroad each year for **2** or more consecutive years, then the person is not member of the national insurance from actual date

Source: § 2-1 subsection 4 second part

Rules a. and b. give different results. § 2-1 subsection 4 second part could possibly be interpreted as that you could stay as a member of the National Insurance for two more years if you do not plan in advance the duration of your stay abroad.

3.1.4 Contribute to reformulation of the law text itself

Generating vocabulary and rules has, besides the findings in 3.1.1 and 3.1.2 which were clarified through the supplementary SBVR-formulations, enforced amplifications that have entailed suggestions to reformulations of the law text itself. This was maybe the most surprising finding. In all three cases the transforming to SBVR enforced alternative, often more precise, formulation of the law text itself.

Example:

§ 2-5 deals with persons abroad who according to their kind operations abroad, still could be member of the National Insurance. Focus is on the text in italic.

§ 2-5, second subsection third part

“The spouse of a person mentioned in first section letter c to f, *must have been a member of the National Insurance for at least three of the last five calendar years.*”

First, what is the meaning of “*at least three of the last five calendar years*”? It could be interpreted as that member of the National Insurance is something you are a whole calendar year, but the rest of the law doesn't indicate that. Does it mean that it is sufficient having a membership that includes periods that are in connected with at least three of the last five years, but that the duration of the periods are not important? Instinctively I believe what is meant, is that the sum of the duration of the member periods should be at least three years in the course of the last five years. A more

precise formulation could be “in sum at least three years during the last five calendar years”.

Second, what is the meaning of “*at least three of the last five calendar years*”. Last five calendar years from when? § 2-5 is about residence abroad. I suppose it means actual date measured against date of departure for the residence abroad. It could have been formulated more precisely by “at least three of the last five calendar years on the date of departure for the residence abroad”.

Third, what is the meaning of “*at least three of the last five calendar years*”. If the residence abroad starts 1 October, what is the last calendar year (or last five calendar years)? Is it 2009? Is it 2008? Is it the last twelve months from 1 October 2008 – 1 October 2009? In this case “at least three of the last five years on the date of departure for the residence abroad” would have been a more precise formulation.

To summarize, the law text could be rephrased to the following text which is possible to deduce a rule from:

§ 2-5, second subsection, third part - rephrased

The spouse of a person mentioned in first section letter c to f, *must have been a member of the National Insurance for at least a total duration equal to three years during the last five years at the time the stay abroad is initiated.*

3.2 Findings related to SBVRs ability to express the law text in a way making it easier to transform the law text into programming code

3.2.1 Unambiguous definitions of terms

A SBVR compliant vocabulary supports definition of terms at any level. Depths in the language can be expressed by recursively defined terms in SBVR. Here is a simple example:

date

Definition: time that is to the precision of year-month-day

start date

Definition: date something starts

end date

Definition: date something ends

period

Definition: a time interval measured from a start date to an end date

Supporting fact types: [period has start date](#)
[period has end date](#)
[period has duration](#)
Necessity: [start date is before end date](#)

[member period](#)

Definition: [period that is included in a membership in the national insurance](#)

[membership in the national insurance](#) [includes at least 1 member period](#)
Concept type: [partitive-fact-type](#)

The concept [member period](#) inherits the attributes of [period](#). [member period](#) recursively refers [period](#) which recursively refers [start date](#) which recursively refers [date](#).

3.2.2 Rich language that ensures common understanding

Precise formulations are essential for common understanding of the same law. In addition to the definitions in the vocabulary, SBVR offer statements and rules, supplemented by fact types and synonymous formulations, all based on logical formulations. Example:

[If a person moves to Norway and has residence permit and the resident is intended to last at least 12 months, then the person is member of the national insurance from date of arrival](#)

Synonymous Form: [It is not necessary that a person who moves to Norway and has residence permit and the resident is intended to last less than 12 months, is member of the national insurance](#)

Source: § 2-1 subsection 2

Note: In this case a person can apply for voluntary membership in the national insurance in accordance with [National Insurance Act](#) § 2-7

3.3 Supporting different usage groups

3.3.1 Practicable to exchange between institutions

The ‘SBVR-format’ with the characteristic font, colour- and indent- combination, is easy to identify and is itself, without any transformation, suitable for exchanging. However one of the main purposes with SBVR was to exchange SBVR documents between institutions, and the SBVR standard includes a specification of transforming SBVR to xml-format for exchanging by XMI [OMG 2008].

3.3.2 Simple to use

You do not have to be an IT-technologist to be a SBVR modeler. To be able to do logic analysis is the most important. The legislator has the major advantage by the fact that he knows the intention with the legislation. This will make it easier to transform it into rules. Anyway, an introduction- and education program in SBVR would be helpful, if not essential.

3.3.3 Supporting tools

SBVR can be used without any tools. However using tools can ensure consistence in vocabulary and rules difficult to gain manually. There are SBVR-compliant editors as [RuleArts] FactXpress and RuleXpress. Through these tools, it will also be possible to interface with BRMS and gain an automated transformation from legal rules to business rules.

4 Conclusion

SBVR modeling can be a useful method both for legislator formulating the law text and for those who interpret and implement it. For legislator, formulating the law, modeling with SBVR can represent a quality assurance of the law formulation and reduce need for later adjustments. For the institutions implementing the law, the result of the SBVR modeling, the vocabulary and the rules, can contribute to a smoother interpretation and transforming of the law and reduce time spending in the analyze phase. The more institutions affected by the same legislation, the more time to be saved. The SBVR documents constitute in this way a semantic ontology, a common interpretation all recipients can adapt to their IT-solutions.

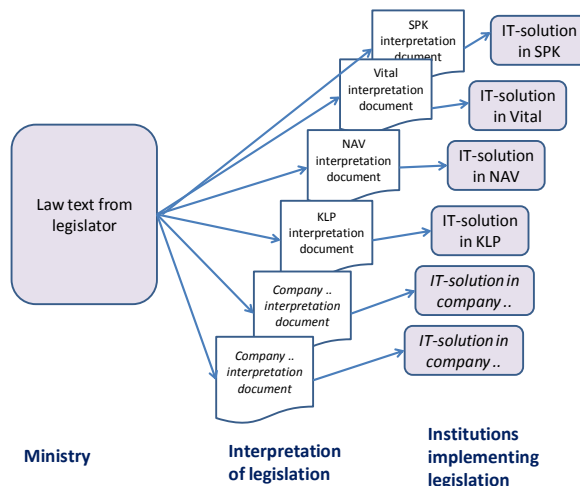


Fig. 1 The situation today – each company do their own interpretation

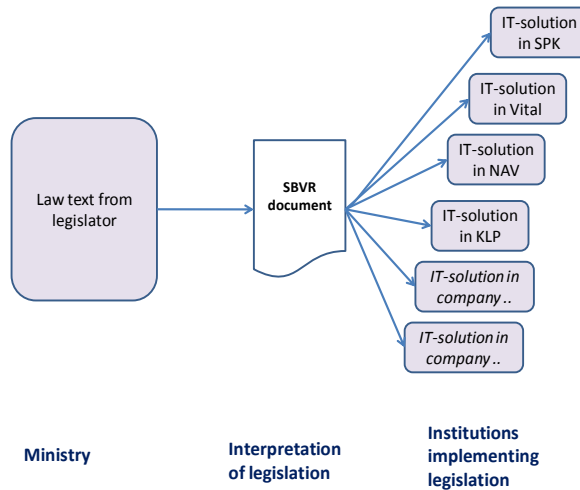


Fig. 2 Tomorrow - SBVR represents a common interpretation as a semantic ontology

5 Future work

A suggested next step is to try out this way of using SBVR on ‘both side of the table’ i.e. to form a business case where both legislator and institution (one or more) participate and evaluate their part in it.

The legislator has to:

- Choose either a new or an adjustment to a law text
- Based on the law text, model vocabulary and rules according to the SBVR specification
- Evaluate SBVR’s effect on the formulation of the law text itself
- Evaluate time spending on modeling the law text with SBVR
- Publish the SBVR-documents in addition to the law

To carry out this part of the business case, an education program in SBVR specially prepared for the non-IT-technologist i.e. the legislator should be available.

The institution(s) have to:

- Evaluate effect on time spending in the analyze phase both in the business- and the IT-department

- Transform vocabulary and rules to a BRMS or other kind of IT-solution
- Evaluate effect on time spending in the implement phase

We are currently working with plans for a further exploration of this approach within Norwegian legislation, and are also considering opportunities for this within the European laws that affect Norway and all other countries in Europe.

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