Qualified Research Under Section 41: The Four-Part Test and the Function of Technical Uncertainty

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Author Note

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Abstract

Founders and engineers often assume that research and development means laboratory work or an invention that is new to the world. The federal credit for increasing research activities uses a different definition. This paper reviews the definition of qualified research in section 41(d) of the Internal Revenue Code and the Treasury regulations that interpret it, reading the statute as amended by Public Law 119-21 in 2025 and the regulations as published on November 28, 2026. It sets out the four requirements commonly called the four-part test, explains that each is applied separately to each business component, and lists the activities the statute excludes. It then argues that technical uncertainty, which the regulations define as the absence of information establishing capability, method, or appropriate design, is the concept an engineering team can most usefully organize its records around, because the evidence for it is clearest at the start of the work and fades once the answer is known. Research on hindsight bias explains why. One finding concerns current law. The first requirement, long called the Section 174 test, now points in the statute to section 174A, while the regulations still refer to section 174. The paper is a review of primary text prepared by an engineering services firm. It is not legal or tax advice, it does not survey case law, and it does not address whether any particular company or activity qualifies. Each claim is graded by the kind of evidence behind it.

Keywords: qualified research, Internal Revenue Code section 41, four-part test, technical uncertainty, business component, process of experimentation

Qualified Research Under Section 41: The Four-Part Test and the Function of Technical Uncertainty

Many founders hear the phrase research and development and picture a laboratory, a patent on the wall, and a result nobody else has reached. They then look at their own company, which shipped a product and fixed a long list of defects, and conclude that the term does not describe them. That picture is a poor guide to the federal tax definition. The regulations under section 41 of the Internal Revenue Code say in terms that a taxpayer need not be seeking information that exceeds, expands, or refines the common knowledge of skilled professionals in the field (Treas. Reg. § 1.41-4(a)(3)(ii)). The question the rules ask is closer to this one: when the work began, did the information available to the team establish how to do it?

This paper sets out what the statute and regulations say qualified research is, in the order an engineer would need to read them. It has three aims. The first is to state the four statutory requirements accurately, with a pinpoint citation for each, so that a reader can check every sentence against the source. The second is to record a change in the statute made in 2025 that affects how the first requirement is named and cited. The third is to argue that one concept, technical uncertainty, deserves more of an engineering team's attention than the others, because of when the evidence for it is created.

The paper does not say that any company, project, or activity qualifies for the credit, and nothing in it should be read that way. Whether particular work meets the statute is a determination that depends on facts and that belongs to a qualified tax professional. The paper also says nothing about how a credit is computed or what it might be worth.

Scope and Method

The paper is a review of primary legal text by a non-lawyer. Three bodies of text were read in full for the provisions cited. The first is the statute: 26 U.S.C. § 41, 26 U.S.C. § 174, and 26 U.S.C. § 174A, read in the release of the United States Code published by the Office of the Law Revision Counsel that is current through Public Law 119-149, together with section 70302 of Pub. L. No. 119-21 (2025), the act that amended them. The second is the Treasury regulations at Treas. Reg. § 1.41-4 and Treas. Reg. § 1.174-2, read in the Electronic Code of Federal Regulations on November 28, 2026. The third is the instructions the Internal Revenue Service publishes for the form on which the credit is claimed (Internal Revenue Service, 2025).

Case law was not surveyed. These provisions have a long history in the courts, and what a requirement means in practice often turns on those decisions. Three decisions were considered for inclusion and left out because their text could not be retrieved from a primary source during preparation. A reader who intends to rely on any statement here should have a certified public accountant or tax attorney review it first. The two works of psychology cited in the section on hindsight were checked against their published records, and their findings are used only for the general proposition stated there.

The Statutory Structure

Four Requirements

Section 41 allows a credit for increasing research activities. The credit is computed from qualified research expenses, and those in turn depend on the definition of qualified research in subsection (d). Under 26 U.S.C. § 41(d)(1), qualified research means research that meets three lettered conditions, the second of which has two parts. Counted in order, that makes four

requirements. The Internal Revenue Service (2025) describes them in its form instructions as requirements that are commonly referred to as the four-part test. Table 1 gives each requirement with its statutory and regulatory source and a plain question that an engineering team can answer.

Table 1

The Four Requirements of Qualified Research and Their Sources

Requirement	Statute	Regulation	Question for an engineering team
Research expenditure requirement (long called the Section 174 test)	26 U.S.C. § 41(d)(1)(A)	Treas. Reg. § 1.174-2(a)(1)	At the start, what was not known: whether it could be done, how to do it, or what the design should be?
Discovering information that is technological in nature	26 U.S.C. § 41(d)(1)(B)(i)	Treas. Reg. § 1.41-4(a)(3), (a)(4)	Which science or engineering discipline did the work rely on to resolve it?
Business component	26 U.S.C. § 41(d)(1)(B)(ii), (d)(2)	Treas. Reg. § 1.41-4(b)	What, specifically, was being built or improved?
Process of experimentation	26 U.S.C. § 41(d)(1)(C), (d)(3)	Treas. Reg. § 1.41-4(a)(5), (a)(6)	What was tried, what happened, and what changed as a result?

Note. The questions in the last column are the author's paraphrase for use in interviews. They are not the legal test and do not substitute for it.

The statute also ends the definition with a sentence of exclusion. Qualified research does not include any activity described in paragraph (4) of the subsection (26 U.S.C. § 41(d)(1)). Those exclusions are taken up later in this paper.

The Unit of Analysis Is the Business Component

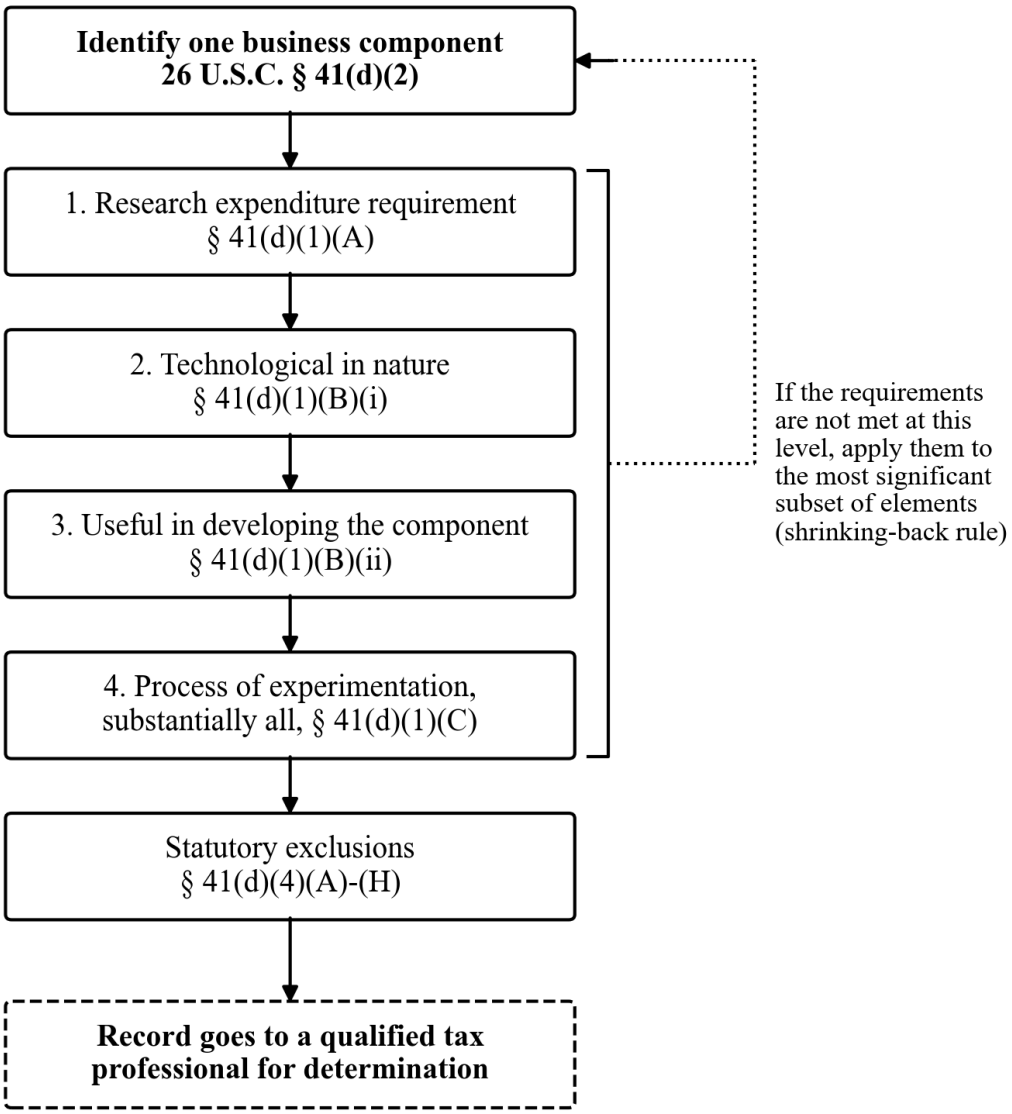
None of this is tested against the company as a whole, or against a whole tax year. The statute directs that the requirements be applied separately with respect to each business component of the taxpayer (26 U.S.C. § 41(d)(2)(A)). A business component is any product, process, computer software, technique, formula, or invention that is to be held for sale, lease, or license, or used by the taxpayer in a trade or business of the taxpayer (26 U.S.C. § 41(d)(2)(B)).

A plant process, machinery, or technique for commercial production of a business component is treated as a separate business component and not as part of the component being produced (26 U.S.C. § 41(d)(2)(C)).

The regulations add a rule for cases where a whole product does not meet the requirements. The requirements are applied first at the level of the discrete business component. If they are not met at that level, they are applied to the most significant subset of elements of the component, and this continues until either a subset that satisfies the requirements is reached or the most basic element is reached and fails (Treas. Reg. § 1.41-4(b)(2)). The regulations call this the shrinking-back rule. Figure 1 shows the order in which the provisions are read for one component.

Figure 1

Order in Which the Requirements of Section 41(d) Are Read for One Business Component



Note. The figure shows the reading order of the provisions cited in this paper. It is not a decision tool, and reaching the last box says nothing about whether any activity qualifies. The shrinking-back rule is at Treas. Reg. § 1.41-4(b)(2).

For an engineering team the practical consequence is that the honest description of most years is mixed. A team might spend one quarter on a hard problem and discard three architectures along the way, then spend two quarters on ordinary feature delivery. Those are different business components or different activities within one, and the statute looks at each on its own. A list of projects is therefore a more useful starting point for a conversation with a tax professional than a description of the company.

The Research Expenditure Requirement After 2025

The first requirement has changed its statutory wording more than once. Before July 2025 it read: research with respect to which expenditures may be treated as specified research or experimental expenditures under section 174. Section 70302(b)(2)(A) of Pub. L. No. 119-21 (2025) replaced it. The subparagraph now reads: research with respect to which expenditures are treated as domestic research or experimental expenditures under section 174A (26 U.S.C. § 41(d)(1)(A)). The same act added section 174A, which defines domestic research or experimental expenditures as research or experimental expenditures paid or incurred by the taxpayer in connection with its trade or business, other than those attributable to foreign research (26 U.S.C. § 174A(b)). Section 174 now addresses foreign research or experimental expenditures (26 U.S.C. § 174(a), (b)).

Practitioners have long called this requirement the Section 174 test, and the regulations still use that reference. The regulation that lists the requirements describes the first as research with respect to which expenditures may be treated as expenses under section 174 (Treas. Reg. § 1.41-4(a)(2)(i)). The version of that regulation in force on the date of this paper was last amended before the 2025 act. A reader will therefore meet both labels. This paper uses the

neutral name research expenditure requirement and cites the statute as it now reads. How the older regulatory language is to be applied under the amended statute, and which taxable years each version governs, are questions for a tax professional.

Neither section 174 nor section 174A defines the phrase research or experimental expenditures. The definition is in the regulations. It covers expenditures incurred in connection with the taxpayer's trade or business that represent research and development costs in the experimental or laboratory sense. Expenditures have that character if they are for activities intended to discover information that would eliminate uncertainty concerning the development or improvement of a product (Treas. Reg. § 1.174-2(a)(1)). Two further sentences in the same paragraph matter to engineers. Whether expenditures qualify depends on the nature of the activity to which they relate, not on the nature of the product or the level of technological advancement it represents. The ultimate success, failure, sale, or use of the product is not relevant to that determination.

The treatment of these expenditures as deductions or capitalized amounts is a separate subject. It has changed more than once in recent years and it is outside the scope of this paper.

Discovering Information That Is Technological in Nature

The second requirement has two halves in the regulations. Research is undertaken for the purpose of discovering information if it is intended to eliminate uncertainty concerning the development or improvement of a business component (Treas. Reg. § 1.41-4(a)(3)(i)). Information is technological in nature if the process of experimentation used to discover it fundamentally relies on principles of the physical or biological sciences, engineering, or

computer science, and a taxpayer may employ existing technologies and existing principles to satisfy the requirement (Treas. Reg. § 1.41-4(a)(4)).

Three clarifications in the same regulation correct common assumptions. First, as noted in the introduction, the taxpayer need not be seeking information that exceeds, expands, or refines the common knowledge of skilled professionals in the field. Second, the taxpayer need not succeed in developing a new or improved business component (Treas. Reg. § 1.41-4(a)(3)(ii)). Third, the issuance of a patent, other than a design patent, is conclusive evidence that the taxpayer has discovered information that is technological in nature, but a patent is not a precondition for the credit (Treas. Reg. § 1.41-4(a)(3)(iii)). That evidence goes to this one requirement and not to the others.

A fourth clarification cuts the other way. The use of computers or information technology, or reliance on principles of computer science to store, collect, manipulate, or process data, does not itself establish that qualified research has been undertaken (Treas. Reg. § 1.41-4(a)(7)). Writing software is not, by that fact alone, research.

The Process of Experimentation

The fourth requirement is that substantially all of the activities constitute elements of a process of experimentation for a permitted purpose (26 U.S.C. § 41(d)(1)(C)). Research is conducted for a permitted purpose if it relates to a new or improved function, to performance, or to reliability or quality (26 U.S.C. § 41(d)(3)(A)). It is in no event treated as conducted for a permitted purpose if it relates to style, taste, cosmetic, or seasonal design factors (26 U.S.C. § 41(d)(3)(B)).

The regulations define a process of experimentation as a process designed to evaluate one or more alternatives to achieve a result where the capability or the method of achieving that result, or the appropriate design of that result, is uncertain as of the beginning of the taxpayer's research activities. The process involves three things: identifying the uncertainty, identifying one or more alternatives intended to eliminate it, and identifying and conducting a process of evaluating the alternatives, for example through modeling, simulation, or a systematic trial and error methodology (Treas. Reg. § 1.41-4(a)(5)(i)). The same paragraph says the process must be an evaluative one and generally should be capable of evaluating more than one alternative.

Engineers tend to skip one sentence in that paragraph. Uncertainty concerning the development or improvement of a business component does not establish that all activities undertaken to achieve it constitute a process of experimentation. Uncertainty is necessary. The evaluation of alternatives is a separate thing that has to be shown as well.

The regulations put a number on substantially all. The requirement is satisfied only if 80% or more of the taxpayer's research activities with respect to a business component, measured on a cost or other consistently applied reasonable basis, constitute elements of a process of experimentation for a permitted purpose (Treas. Reg. § 1.41-4(a)(6)). The requirement is applied separately to each business component. How that fraction is measured for a given team is a matter for its tax professional.

Technical Uncertainty as the Organizing Concept

Uncertainty appears in the regulations under three of the four requirements. It defines research or experimental expenditures (Treas. Reg. § 1.174-2(a)(1)). It defines the purpose of discovering information (Treas. Reg. § 1.41-4(a)(3)(i)). It is the first element of a process of

experimentation (Treas. Reg. § 1.41-4(a)(5)(i)). The wording is nearly the same each time: uncertainty exists if the information available to the taxpayer does not establish the capability or method for developing or improving the product or component, or its appropriate design. This section argues that an engineering team should treat that definition as the center of its record.

Three Forms

The definition names three things that the available information may fail to establish. The examples that follow are illustrations written by the author. They are not drawn from the regulations and they do not indicate that any similar project would meet the test.

The first form is capability. The team does not know whether the result can be achieved at all. Can response time be held under a stated threshold on the target hardware? Can a sensor resolve a feature of a given size at a given distance?

The second form is method. The team believes the result is achievable and does not know how to reach it. The open question is which algorithm, which architecture, or which manufacturing process will work.

The third form is appropriate design. The team knows the result is achievable and roughly how, and does not know the design that will meet all of the requirements together. The regulations confirm that this form is sufficient by itself: a taxpayer may undertake a process of experimentation where there is no uncertainty about capability or method, so long as the appropriate design is uncertain at the beginning of the research activities (Treas. Reg. § 1.41-4(a)(5)(i)). A single project can carry more than one form.

What the Definition Leaves Out

The definition is specific about its subject. It concerns capability, method, and design in the development or improvement of a product or component. On the author's reading, several kinds of doubt that teams experience every day fall outside those words. Doubt about whether customers will buy the product is a commercial question, and the statute separately excludes market research, testing, or development from qualified research (26 U.S.C. § 41(d)(4)(D)(iii)). Doubt about whether the work can be finished by a date or within a budget concerns planning. Neither is described by the regulation's three terms.

The reference point also matters. The regulation asks what the information available to the taxpayer establishes. A team that could have resolved a question by reading the documentation for a tool it already uses is in a weaker position to say the information was unavailable. How far a taxpayer is expected to look before information counts as unavailable is not stated in the paragraphs reviewed here, and it is the kind of question on which case law and professional judgment govern.

The Hindsight Problem

Every element of the definition is fixed to a point in time. The process of experimentation provision speaks of uncertainty as of the beginning of the taxpayer's research activities. The difficulty is that people are poor witnesses to their own earlier ignorance. In a set of experiments that opened this field of study, Fischhoff (1975) found that people who were told the outcome of an event judged that outcome to have been more likely than people who were not told, and that they were largely unaware that knowing the outcome had changed their judgment. A later review

of the literature describes hindsight bias as the belief that an event was more predictable after it becomes known than it was before (Roese & Vohs, 2012).

Engineers show the same pattern when they describe solved problems. Ask an engineer about a three-week investigation and the answer is often one line: the cache needed to move in front of the service. That sentence describes the end of the work as though it were the beginning. The approaches that failed drop out of the account, and with them the evidence that there was something to find out. The psychology cited here was not conducted on engineers or on tax records, and it does not show that any particular reconstruction is inaccurate. It does give a reason to expect that an account written after the answer is known will understate the uncertainty that existed before.

This is the basis for treating uncertainty as the organizing concept. Evidence for the other requirements tends to survive the work. The business component exists and can be named afterward. The discipline relied on can be read from the code, the drawings, or the test data. The alternatives tried often leave traces in version control. The state of the team's knowledge at the start leaves a trace only if someone writes it down then.

Capturing It

A short paragraph written at the start of the work is enough. It states what the team is trying to make work, what it does not know and which of the three forms that is, why the answer is not already available to the team, and what it plans to try first. It carries the date on which it was written, and it is kept where the work is kept: the ticket, the design document, or the description of the first code change. The second paper in this series describes the rest of the record. The regulations do not prescribe this format. It is a practice the author recommends on

engineering grounds, since a team that names what it does not know has to choose what to test first and can see when an approach should be abandoned.

Activities the Statute Excludes

Meeting the four requirements is not the end of the reading. The statute lists eight categories that are not qualified research (26 U.S.C. § 41(d)(4)). Table 2 gives them in the statute's order and words.

Table 2

Activities Excluded From Qualified Research by Section 41(d)(4)

Subparagraph	Statutory heading	What the text excludes
(A)	Research after commercial production	Research conducted after the beginning of commercial production of the business component.
(B)	Adaptation of existing business components	Research related to adapting an existing business component to a particular customer's requirement or need.
(C)	Duplication of existing business component	Research related to reproducing an existing business component from a physical examination of it or from plans, blueprints, detailed specifications, or publicly available information.
(D)	Surveys, studies, etc.	Efficiency surveys; activity relating to management function or technique; market research, testing, or development; routine data collection; routine or ordinary testing or inspection for quality control.
(E)	Computer software	Except as regulations provide, research on software developed by or for the taxpayer primarily for its internal use, with stated exceptions.
(F)	Foreign research	Research conducted outside the United States, the Commonwealth of Puerto Rico, or any possession of the United States.
(G)	Social sciences, etc.	Research in the social sciences, arts, or humanities.
(H)	Funded research	Research to the extent funded by any grant, contract, or otherwise by another person or governmental entity.

Note. Paraphrased closely from 26 U.S.C. § 41(d)(4)(A)-(H). The statutory text controls.

The software exclusion in subparagraph (E) needs a further word because so many technology companies build tools for their own use. The regulations provide that research on

software developed primarily for the taxpayer's internal use is eligible only if it meets the general requirements, is not otherwise excluded, and also satisfies what the regulations call the high threshold of innovation test (Treas. Reg. § 1.41-4(c)(6)(i)). Software is treated as developed primarily for internal use if it is developed for use in general and administrative functions that facilitate or support the conduct of the taxpayer's trade or business (Treas. Reg. § 1.41-4(c)(6)(iii)). The additional test asks whether the software is innovative, whether its development involves significant economic risk, and whether comparable software is commercially available (Treas. Reg. § 1.41-4(c)(6)(vii)). A team whose work may fall in this category should raise it with its tax professional early, since the classification affects which standard applies.

Implications for Engineering Teams

Three implications follow for a team that wants its tax professional to be able to do the job well. None of them depends on a view about whether the team's work qualifies.

First, the record should be organized by business component, since that is the level at which the statute applies each requirement. The form instructions point the same way. For tax years beginning after 2025, the Internal Revenue Service (2025) states that the section of the credit form that reports information by business component will be required, subject to exceptions set out in the instructions, after having been optional for earlier years. The instructions are revised from time to time and should be read in their current version.

Second, the four requirements make a workable outline for the record of each component: what was uncertain, what discipline resolved it, what was being built, and what was tried. Teams rarely lack a record because the work was not real. More often nobody wrote down the uncertainty at the start or the alternatives along the way, and a year later the record shows a

finished feature and a list of code changes. That observation comes from the author's practice and is not a measured finding.

Third, the list a team brings to its tax professional can start small. A useful first version names the projects where, at the outset, someone on the team said that they were not sure the approach would work. Whether any item on that list meets the statute, and what follows if it does, is for the tax professional to determine.

Evidentiary Status of the Claims in This Paper

The claims in this paper are of different kinds and should not be given the same weight. Table 3 states the kind of each principal claim and what would strengthen it.

Table 3

Kind of Evidence Behind Each Principal Claim

Claim	Kind	What would strengthen it
The four requirements, the business component rule, the permitted purposes, and the eight exclusions	Statutory. Read from the current text of section 41(d).	Review by a tax attorney. A survey of case law applying each provision.
The first requirement now refers to section 174A	Statutory. Read from Pub. L. No. 119-21 and the current Code.	Treasury or IRS guidance on how existing regulations apply under the amended text.
Definitions of uncertainty, technological in nature, process of experimentation, and the 80% measure	Regulatory. Read from the current regulations.	Case law on how each definition has been applied to software and hardware development.
Business, schedule, and budget doubts fall outside the definition of uncertainty	The author's reading of the regulation's wording, supported in part by the market research exclusion.	Authority that addresses the point directly.
People overstate in hindsight what was knowable in advance	Experimental psychology, established in general populations.	Studies of engineers recalling technical decisions.
Uncertainty is the requirement whose evidence fades fastest	Structural argument by the author.	Empirical comparison of records made during and after development work.
Teams usually lack records because nothing was written at the start	Practitioner observation. Not measured.	A sample of documentation engagements with stated selection criteria.

Limitations

This paper has clear limits. It was written by an engineer from the text of the statute and regulations and has not been reviewed by a tax professional. It does not survey case law, revenue rulings, or other administrative guidance beyond the one set of form instructions cited, and those sources can narrow or qualify what the bare text appears to say. Three court decisions were considered and omitted because the opinions could not be read in a primary source at the time of writing. The paper reads the statute and regulations as they stood on November 28, 2026. Both have changed in the past and may change again, and the regulations cited have not yet been revised to reflect the 2025 amendment. The paper leaves out several subjects entirely: the

computation of the credit, the definition of qualified research expenses, the deduction or capitalization of research expenditures, the payroll tax election, and the requirements for claiming a refund. The author's firm sells services in this area, and readers should weigh the paper's emphasis on record keeping with that interest in mind.

Conclusion

The statutory definition of qualified research is narrower than the everyday meaning of research and development in some respects and broader in others. It does not require a laboratory, a patent, success, or a result that is new to the field. It does require, for each business component separately, that four conditions be met and that none of eight exclusions apply. Uncertainty about capability, method, or appropriate design runs through three of the four conditions, and it is the one for which evidence is easiest to lose. Keeping that evidence costs a team one paragraph, written before the work starts, on what it does not yet know. Whether the work that follows meets the statute remains a question for a qualified tax professional.

Disclaimer

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