The 40 Inventive Principles of TRIZ Applied to Finance

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INTRODUCTION

As I studied the TRIZ Inventive Principles and the Contradiction Matrix, I thought about how the 40 Inventive Principles could be applied to finance. I identified one application, then another. Then, I made a list. What soon followed were many enjoyable evenings spent listing financial applications of the 40 Inventive Principles as they came to mind, often faster than I could write them down!

To better organize my list and notes, I followed Ellen Domb and Karen Tate's format from their course, "Practical Innovation". **[1]** This yielded a well-filled, but very rough list that included many applications which I could not match well to any inventive principle, and about a dozen inventive principles for which I had few or no matching applications.

REFINING THE LIST

The next step was to refine the list. For the principles that could not be applied to finance exactly as stated, the task I faced was to translate them in a way that remained as true as possible to the original concepts of the inventive principles, while having clear and broad application to finance.

The philosopher Ayn Rand identified a principle, known as Rand's Razor, which states: "Concepts are not to be multiplied beyond necessity - the corollary of which is: nor are they to be integrated in disregard of necessity." **[2]** I found this guidance to be most helpful as I attempted to apply the underlying concepts of the 40 Inventive Principles to finance.

I was able to translate nine of the remaining twelve principles very closely. When I did so, they covered the unmatched financial applications in my list. Here are three examples of how I made the necessary translations:

Principle 8. Anti-weight:

For money not backed by gold or silver (Is there today, any regularly-circulating money in the world that <u>is</u> backed by gold or silver?), price inflation is pervasive, like gravity. Inflation is the consistent, exponential (at a varying rate) decay over time, of the purchasing power of an unbacked currency. Inflation inexorably pulls down, over time, the value of such money. Like weight, which, given the same mass, can be very different depending on which planet, moon, or asteroid one visits; given the

same initial amount of wealth, the effects of inflation can be very different depending on which currency is used to hold that wealth. The significance of a given rate of inflation, and the need to compensate for it, increase with one's planning time horizon.

Exposure to inflation, unlike other activities such as taking a position in a market, seldom is a matter of choice; it is a consequence of holding wealth in the unbacked currency with which one must work. Because the need to compensate for inflation is so key, and so broadly applicable, to finance, I judged this to be sufficient cause to differentiate inflation from other, voluntary situations where hedging is useful. I concluded that "Compensate for Inflation", like "Anti-weight/Counterweight" in mechanical engineering, merits a "dedicated" inventive principle, and that it is the closest and best financial translation of Principle 8.

Principle 14. Spheroidality - Curvature:

While spheres and curvature, per se, did not apply well, cycles or repeating patterns are common phenomena in finance. Examples are: seasonal patterns; business cycles; billing cycles; and the sector-rotation patterns in stock prices.

In the list, I specify Principle 14 as referring to cycles or repeating patterns, usually in the environment, having regular or varying time intervals. In this way, I differentiate this principle from Principle 19, "Periodic action", which refers to repeating or periodic actions taken by individuals to accomplish a purpose.

Principle 32. Color changes:

The color of coins and currency quickly come to mind, but this is more a matter of aesthetics, ergonomics, and error-proofing, not directly related to finance per se. However, the expression "color of money" has a meaning relating to allocation of funds, which is a key concept in finance. **[3]** The corresponding physical (administrative?) contradiction is: "I have sufficient funds, but I do not have sufficient funds (because the funds are in the wrong account)." This is a common situation. Thus, Inventive Principle 32, translated into financial terms, becomes "Allocation".

The following is the list of the nine inventive principles for which I found it necessary to make a translation to finance. For clarity both here, and in the list of principles, I leave the original name of the each principle in parentheses, followed by its financial translation. In the list of financial inventive principles, I give a brief explanation of each translation.

Principle 8. (Anti-weight/Counterweight) Compensate for inflation
Principle 14. (Spheroidality - Curvature) Cycles

Principle 30. (Flexible shells and thin films) Flexibility
Principle 32. (Color changes) Allocation
Principle 36. (Phase transitions) Liquidity
Principle 37. (Thermal expansion) Relative change
Principle 38. (Strong oxidants) High-risk environment, market, or position:
Principle 39. (Inert environment) Low-risk environment, market, or position
Principle 40. (Composite materials) Composite structure

I did not find sufficient examples in finance for three principles: 18, 29, and 31; nor did I find appropriate, broadly applicable translations consistent with their underlying concepts.

Principle 18. Mechanical Vibration:

In mechanics, "vibration" is high-frequency action, typically having a period of one second or less, which is well above frequency range of most human activities. For human activities, "vibration" reasonably could be extended to periods on the scale of minutes, up to a few hours at most. The one example that comes to mind is the day traders who seek to glean profits from the "vibration" or "noise" of intraday price moves in a market. Most cyclical phenomena and periodic activities in finance are well covered by Principles 14 and 19.

Principle 29. Pneumatics and Hydraulics:

"Pneumatics" immediately suggests inflation. However, when I examined the underlying concepts, I judged that "weight" was the more applicable concept, and that Principle 8 was the more exact match for inflation. I did not find other applications for this principle, or its underlying concept.

Principle 31. Porous Materials:

"Loopholes", those exploitable openings or voids in the terms of a contract, agreement, or law, was the one application that came to mind here, although this is far more applicable to the discipline of law. Again, I did not find other applications for this principle, or its underlying concept.

Respecting Ayn Rand's Razor, I judged it best to leave Principles 18, 29, and 31 open for now.

TIME, MONEY, RISK, AND THE EQUIVALENCE PRINCIPLES

The three domains of finance are time, money, and risk. Much of finance consists of finding optimal positions in terms of (time, money, risk). Some examples are: selecting an investment; and financing a project. These three domains are at the root of many, if not most, key technical contradictions in finance.

For example: Increase the return (money/(money*time)) of an investment while decreasing the risk. Typically in investment situations, improvement can be achieved in one or two of these domains at the cost of worsening the third. An alternative investment may mature sooner, yield a higher rate, or a combination of the two; however, usually the alternative investment will have a higher risk.

Innovation in finance finds non-contradictory solutions in the domains of time, money, and risk. An example, in modern portfolio theory, is the concept of the "efficient frontier", below which risk can be reduced while holding return constant; or return can be increased while holding risk constant; or return can be increased while reducing risk. **[4] [10a]** The key is to recognize that "risk" consists of two separate components: company-specific or industry/sector-specific risk, which can be minimized by diversification; and market risk (the effect of adverse moves of the entire market) which cannot be diversified away. This is an application of Principle 1, "Segmentation". To remove the risk related to companies and industry-specific sectors, choose portfolio components (i.e., stocks) with low or negative short-term correlation. This is an example of Principle 9, "Preliminary anti-action", and Principle 37, (Thermal Expansion) Relative Change. The return can further be increased, or the risk further reduced, or both, by holding a portion of the portfolio in "risk-free" or low-risk securities, e.g., government treasury bonds or high-grade corporate bonds, which are less correlated with the market. In effect, the efficient frontier can be moved outward by including in the portfolio, a less-correlated low-risk component. This is an application of Principle 39, "(Inert environment) Low-risk environment, market, or position".

Improvement often can be achieved in project-financing situations by substituting one domain for another. For example, where possible, spend money (by hiring extra labor, working overtime, etc) to shorten the time required by activities on the project's critical path, thereby reducing the total duration of the project, and perhaps the project's cost and risk as well.

The domains of time, money, and risk also are a way to categorize the solution strategies within the inventive principles themselves. In Principle 1, Segmentation, for example, one can separate money (cashflows) in time; separate risk in time; and separate time (activities) in time. Categorizing solutions within inventive principles by time, money, and risk appears most applicable to principles 1, 2, 5, 6, 9, 30, 34, 35, and 37.

Observing this pattern occurring over and over again in the applications and examples led me to identify three interrelated "Equivalence Principles of Finance":

Time and money are equivalent;
Risk and money are equivalent; and
Time and risk are equivalent (this is the corollary of the first two).

These principles can be summarized as, "Time is money; risk is money; time is risk".

These principles are, in one respect, inventive principles; that is, their application can directly remove contradictions. The principle, "Time and Money are Equivalent" is applied in the example above wherein money is spent in order to gain time. The Equivalence Principles also are "organizing principles"; that is, they organize the search for inventive solutions.

To use the Equivalence Principles when searching for an inventive solution in finance, examine the situation and its contradiction(s) from all three points of view: time, money, and risk. Apply the inventive principles to the domain wherein the contradiction lies. If the contradiction cannot be removed from that domain, the equivalence principles can be used to transform the problem and perhaps, to shift the contradiction to another domain. The attempt again is made to remove the contradiction. Sometimes the transformation will remove the contradiction, but will create another which more easily may be removed.

While the Equivalence Principles may qualify as "special" inventive principles for finance, given their organizing power, I do not want to limit them to that role. For now, I leave these principles unnumbered, and refer to them both here, and in the list, as the "Equivalence Principles of Finance", in order to differentiate them from the 40 inventive principles.

OBSERVATIONS AND REFLECTIONS

The three domains of time, money, and risk, and the three Equivalence Principles, also apply to operations research and project management, and may be useful organizing principles for TRIZ work in those disciplines.

When applying TRIZ to different disciplines, look for organizing patterns in the knowledge, and try to identify the underlying principles. Do other disciplines have their versions of the Equivalence Principles?

I found that 37 of the 40 Inventive Principles applied well to finance. Considering the differences between mechanical engineering and finance, this is pretty amazing. There may be applications for the remaining three principles, although this is not necessarily so, given the differences between finance and mechanical engineering.

Will finance have "combined" or "special" principles, as the authors of Matrix 2003 found for engineering systems? Most certainly!

First, a quick examination of the 37 Most Important Combined and Special Principles of Matrix 2003 immediately suggests a few candidates for further examination **[5]**:

Principle 48. Partial Preliminary Action: "Earnest money" paid to the seller (e.g., of a house) becomes part of the downpayment on the purchase. Usually, the rest of the downpayment is made when the sale is closed, and a loan is taken for the balance.

Principle 52. Retain Information for Later Use: Companies that bill customers, and credit bureaus, keep records of creditworthiness. (Stores that offer customer-identification "discount" cards, and keep records of individual customers' purchases for later marketing efforts, also apply this principle.)

Principle 57. Reduce Stages of Energy Transformation: Translated to finance: Reduce Intermediate Transactions. (Note, this principle also may be a law of evolution in finance.)

Principle 69. Increase the System's Resistance to the Harmful Effect: This may be a more exact statement (or a summarizing statement) of the combination of principles at work in the "efficient frontier" of modern portfolio theory, discussed above.

Principle 73. Facilitate Detection: Applies to accounting, financial control, auditing, and security-related practices.

Regarding "combined" principles, there are many broadly-applicable techniques in finance that make use of several inventive principles.

For example, when one buys an option, say, a "put" option on a stock that is held for investment, one takes a preliminary action (Principle 10) with the help of an intermediary (Principle 24) who writes the option, a relatively cheap, short-lived object (principle 27), and accepts the associated risk in exchange for a premium, in order to create an "inert" low-risk environment (Principle 39) for the buyer of the option.

Should "use options" be a special or combined principle? I do not yet have sufficient data to say. Observe that the option is the financial community's way of integrating Principles 10, 24, 27, and 39; suggesting that the purchase of an option might be one implementation (of many) of a "standard solution" in financial TRIZ. For example, in mechanical engineering, Standard Solution 1-2-3 reads, "If it is required to eliminate the harmful effect of a field upon a substance, the problem can be solved by introducing a second substance that draws off upon itself the harmful effect of the field." **[6]** Translated into financial terms, this standard might read: "If it is required to limit risk for a period of time, the problem can be solved by introducing an intermediary who accepts the risk in exchange for a monetary premium." This use of options may be well defined as both a special/combined inventive principle, and as a standard solution in finance.

Inventive principles, like concepts, must not be multiplied beyond necessity, nor integrated or combined in disregard of necessity. To avoid doing so, I suggest here that the tests of a proposed candidate principle must evaluate (at a minimum) the following:

For a "special" or new principle (to avoid multiplying principles beyond necessity):

Its power to remove contradictions not well-addressed by existing principles; and
Its broad, or frequently recurring, application to the discipline.

For a combined principle (to avoid integrating or combining principles in disregard of necessity):

Its broad, or frequently recurring, application of the particular combination of of inventive principles to the discipline.

I also suggest that, in order to properly evaluate these tests of a candidate inventive principle, one must have a contradiction matrix for the discipline in question. In other words, one must first identify all the improving/worsening parameters, and develop a good map of which existing inventive principles remove the contradictions.

While I am confident that finance will, indeed, have its own set of combined and special principles, lacking sufficient data and a contradiction matrix for finance, I have chosen not to include in my list at this time, other than the Equivalence Principles, any combined or special inventive principles for finance.

NEXT STEP: DEVELOP THE CONTRADICTION MATRIX

I do believe that categorizing the financial parameters to be improved, and those that worsen, in terms of time, money, and risk, is the appropriate way to organize a contradiction matrix for finance. My inspiration here is Matrix 2003, which categorizes the improving/worsening parameters as physical, performance, efficiency, 'ility, manufacture/cost, and measurement. **[5]**

This is a work in progress. I now have turned my attention to identifying improved/worsening parameters; and to developing the contradiction matrix. This effort no doubt will identify more applications in finance and suggest further refinement of the financial inventive principles. It also may suggest appropriate translations and applications for the elusive Principles 18, 29, and 31.

Meanwhile, I offer the 40 Inventive Principles and the 3 Equivalence Principles of Finance to readers of the Triz Journal on the same terms as other works in the Journal's "Inventive Principles" series: that is, readers have permission to make a single copy for personal study.

Enjoy!

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The 40 Inventive Principles of TRIZ Applied to Finance - With Examples

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Principle 1. Segmentation

Divide a business, investment, security, or portfolio into independent parts.
Divide a business into divisions.
Stock split
Stripped bond
Spinoff

Principle of financial control: require two or more persons to approve a transaction.

Make an object easy to disassemble.
Form subsidiaries or divisions of companies - which more easily can be bought or sold.

Separate money in time.
Deferred payments or compensation
Seller financing
Advance or delay making or receiving discretionary payments.
Arrange to realize a gain or loss at a time chosen to minimize taxes.

Increase the degree of fragmentation or separation in time.
Annually, quarterly, monthly, weekly, or daily compounding of interest.

Distribute over money time (the limiting case of separation in time).
Continuous compounding of interest
Accept a stream of payments. e.g., royalty or annuity, instead of a single payment.
Stage a project to distribute expenditures over time.
Distribute maturity or renewal dates over time, rather than coming due at once.

Separate money in risk.
For example, when financing a company, seek funding from different sources of capital that have different degrees of risk tolerance (and different time horizons, costs, and degrees of risk for the company to be financed):
Secured lenders, e.g., banks
Bondholders
Preferred stockholders
Common stockholders
Venture capitalists
A new firm may need financing from venture capitalists (high risk tolerance, high cost) to start, but will move to lower-cost, lower-risk-tolerance sources of funds as the as the venture's business succeeds.

Separate risk in time.

Increase the degree of fragmentation or separation in time.

Distribute risk over time (the limiting case of separation in time).

Separate risk in space, or increase the degree of separation.

Space, in the financial sense, includes financial or regional markets, geographic areas, industry sectors, and position in a market.
Diversification

Distribute risk over space (the limiting case of separation in space).

Insurance company underwrites in different regions, or over a wide area, to minimize the impact of local or regional disasters.

Separate time (activities) in time.

Increase the degree of fragmentation or separation in time.

Distribute activities over time (the limiting case of separation in time).

Separate according to a condition or parameter:

Separate money according to purpose.
See also, Principle 32, Allocation.

Separate risk according to type:
Time- and activity-related:
Risk related to passage of time
Risk related to the synchronization of activities (e.g., missed deadlines)
Risk related to adverse side-effects of beneficial activities
Risk related to adverse external events
Money-related:
Risk related to money, assets, and the holding thereof
Financial space-related:
Separate risk which can be minimized by diversification (e.g., sector or company-specific) from that which cannot (e.g., market risk) **[4] [10a]**

Separate time (activities) according to significance.
Pareto Principle: Separate the key 20% from the unimportant 80%.
Separate the critical-path activities from those off the critical path.

Separate the excess from the necessary and sufficient.

Separate the coincident from the inherent; the avoidable from the unavoidable.
(Again) Separating sector or company-specific risk from market risk **[4] [10a]**

Principle 2. Taking out

Remove an interfering part or property from an activity or transaction, or isolate only the necessary or desired parts or properties.

Take out time or activities.
Classes of common stock which carry the right to receive a dividend, but do not represent an ownership interest in the firm.
Non-voting classes of common stock
Disintermediation: eliminate a middleman or an intermediary by transferring or eliminating the function.

Take out money.

Take out risk.
Subchapter S corporation

Limited-liability company

Principle 3. Local quality

Change structure from uniform to non-uniform; change an external environment (or external influence) from uniform to non-uniform.

Make each part function in conditions most suitable for its operation.

Incorporate in a state having favorable business laws, minimum taxes, etc.
Locate manufacturing, distribution, or other operations in an area having the best access to inputs and infrastructure, lowest costs, taxes, regulatory burden, etc.

Make each part fulfill a different, useful, or complimentary function.

Vertical integration

Principle 4. Asymmetry

Take an asymmetric position in the market.

For example, holding put options for more shares of stock than you are "long".
"Strips" and "Straps" are asymetric versions of straddles.

Change a position from symmetrical to asymmetrical (or vice-versa) to offset risk.

If you have put options equal to the shares you are long, add puts if downside risk increases.

If your position is asymmetrical, increase or decrease its degree of asymmetry.

Principle 5. Merging

Merge time or activities.

Make operations contiguous or parallel; bring them together in time.

Combine market positions in order to manage risk, for example:
Buy a stock and sell it short (i.e., sell short "against the box").
Write a "covered" option (i.e., against stock you hold).
Take on "straddle" or "spread" positions.

Merge money.

Debt-consolidation loan

Merge risk.

Bring closer together (or merge) identical or similar objects or activities.

Partnerships
Mergers and acquisitions

Assemble identical or similar parts to perform parallel operations.

Assemble "packages" of securities (e.g., mortgages) to sell in a secondary market.

Assemble identical or similar parts to create a desired property or effect.

Market-index portfolios of securities match the performance of the index;
or approximate the performance of a larger market.

Principle 6. Universality / Multi-Function

Standardize time or activities.

Standard duration of bills, notes, bonds, certificates of deposit, options, etc.

Standardize money; make fungible.

One dollar bill is equivalent to any other. A dollar is a dollar.
Standardize financial instruments, e.g., stocks, options, or futures contracts.

Standardize risk.

Make a part or object perform multiple functions; eliminate the need for other parts.
Offer a brokerage account with check-writing and line-of-credit privileges.

Principle 7. "Nested doll"

Place one object or activity inside another; place each, in turn, inside the other.
Holding company "contains" several related or independent businesses.
Estates
Trusts

Make one part pass through another.
Real-estate mortgage investment conduit.

Principle 8. (Anti-weight / Counterweight) Compensate for Inflation

The financial analogy of weight or gravity is the consistent exponential (at a varying rate) decay over time, of the purchasing power of money which is not backed by gold or silver. Inflation has been significant in the United States since 1913. [7] [8] The longer the time horizon, the more crucial it is to plan for, and compensate for, the effects of inflation.

To compensate for inflation in an investment, merge it with other investments that compensate for inflation by providing financial "lift"; e.g., hedge the investment.
Invest in, or include in a portfolio, components which compensate for inflation:
Real estate, petroleum and mining stocks; and precious metals.
Inflation-protected securities, e.g., U.S. treasury bonds.
Money or bonds backed by, or payable in, gold or silver.
Investments in, and securities denominated in, more stable currencies.

Make an investment or a transaction interact with the financial environment.
Use consumer-price-index (CPI) escalators.
Use fixed or adjustable interest rates:
If borrowing, borrow at fixed rates.
If lending, lend at adjustable rates.
Use a gold or silver clause. **[9]**
Forward-contract interest rates in times of increasing inflation.

Hold wealth in non-cash form.
Real estate
Equities, i.e., those less sensitive to, or those inversely correlated with, inflation.
Petroleum & mining stocks, funds, and indices.
Precious metals (especially, in periods of increasing or high inflation).
Investments denominated in gold or silver.

Hold, or control, assets in the form required for delivery or use.
Hold commodities to be delivered or consumed later.
Forward-contract commodities to be produced, delivered, or consumed later.

Eliminate money entirely from a transaction.
Use non-monetary gold or silver in place of money. **[9]**
Trade present and/or future goods or services.

Principle 9. Preliminary anti-action

If a transaction will have both harmful and useful effects, this transaction should be replaced or augmented with anti-actions to control the harmful effects.

Time or activities:

Restrictive covenants in a loan agreement.
Put in place in advance, defenses against takeovers.

Money:

Lease vs buy to avoid ownership costs and prolonged capital-recovery times.
Buy back stock before/when issuing options, in order to neutralize or prevent dilution.

Risk:

Use negative correlation in an investment or portfolio that will oppose known or expected effects later on.

To minimize the variance of a portfolio's value, assemble a set of components (e.g., stocks) for which the short-term price fluctuations tend to be negatively correlated. **[4] [10a]**
Market-index derivatives can be used to hedge or filter out the effects of changes in a market.

Take both sides of a market position, typically by using options, in order to preserve upside potential while limiting downside risk.

Straddles
See also, Principle 4, Asymmetry; and Principle 5, Merging.

Principle 10. Preliminary action

Perform, before it is needed, the required change of a position or fulfullment of an obligation (either fully or partially, or in a contingent manner).

Establish a sinking-fund to pay a future cost or obligation.
Buy a "put" or "call" option when a stock or commodity is expected to decrease or increase in value.
Take a covered position in a market, e.g, write a covered option.
Write a call option against assets you wish to sell at the price you wish to sell.
Write a put option against assets you wish to buy at the price you wish to buy.
Forward-contract the purchase or sale of assets or commodities at favorable prices.

Targeted investments (defeasance)

Synchronize income from, or maturity of, investments to match future obligations. The income or maturity value of the investment matches the amount of the obligation.

Pre-arrange affairs such that they can come into action from the most convenient place and without losing time for their transaction or delivery.

Place "stop" or "limit" orders to buy or sell a security. These orders automatically execute when a certain price is reached; and are good for a specified time or until they are cancelled.
Pre-negotiate a loan (and lock in interest rates when favorable).
Establish a line of credit.

Pre-arrange affairs to allow taking advantage of a potential favorable situation in the future.

When issuing bonds, make them callable to take advantage of a possible future drop in interest rates.

Principle 11. Beforehand cushioning

Prepare emergency means beforehand to compensate for the relatively low

reliability of an activity, situation, or position.
Require collateral or other security for a loan.
Use recourse.
Buy insurance.
Require a performance or surety bond.
Buy a put option to protect against a fall in value of a stock, future, or index.
Buy a call option to back up a short position.
Put acceleration or foreclosure clauses in a note to make it become due in full upon default, impairment of collateral, or other adverse events.
Negotiate rate caps on an adjustable-rate loan.
Negotiate employment severance agreements (e.g., so-called "golden parachutes").

Principle 12. Equipotentiality

In a market or business environment, limit position changes.
Conduct business in a local currency to manage exposure to exchange-rate fluctuations.
Conduct business with those abroad who accept different currencies.
Use a Eurobank.

Principle 13. "The other way round"

Invert the action(s) used to solve the problem.
Short-term vs long-term financing.

Make movable parts (or the external environment) fixed, and fixed parts movable).
Hedging and forward contracting.
Instead of selling short, buy a "put" option.

Turn the object, process, or activity 'upside down'.
Selling short: sell (borrowed) stock or other asset now; buy it back (and repay) later.

Principle 14. (Spheroidality - Curvature): Cycles

This principle refers to cycles or repeating patterns, usually in the environment, having regular or varying time intervals.

Take advantage of cyclical patterns in the financial environment.
Seasonal patterns
Business cycles
Billing cycles
"Sector rotation" patterns in stock prices

Arrange activities to allow cyclical or repeating patterns of activity.
Revolving credit agreements and charge accounts.

Principle 15. Dynamics

Allow (or design) the characteristics of an object, external environment, or process to change to be optimal or to find an optimal operating condition.
"Optimal f" - the optimum number of units of risk exposure in a portfolio or trading program **[10b]**
Design a portfolio that is on the "efficient frontier"; that is, diversified with respect to sector- or company-specific risk. **[4], [10a]**

Use financial leverage. Financial leverage is the borrowing, use, or control of the assets of others, usually to achieve a multiplying effect on returns.
Caution: The use of leverage usually has a cost (e.g., interest); and it also

multiplies the risk!

"Leverage", in the context of finance, also refers to amplified relative movement or effect. Take advantage of investments or market positions which are capable of amplified movement relative to each other.

Seek assets that rise or fall in value at a greater rate than similar or underlying assets. For example, gold-mining stocks may rise faster percentagewise than the value of gold itself.

If an object, process, or activity is rigid or inflexible, make it movable or adaptive.

Structured debt, i.e., a loan with customized or flexible terms.

Principle 16. Partial or excessive actions

If 100 percent of an objective is hard or risky to achieve using a given solution method then, by using 'slightly less' or 'slightly more' of the same method, the problem may be considerably easier to solve.

Buy a small home to start; build equity more quickly (while avoiding rent and minimizing taxes and insurance); then trade up to a larger home later.

When beginning a venture, "bootstrap", that is, start small and grow from internal funding while proving and refining the business model, in order to minimize the cost, difficulty, and possible ownership dilution of securing outside financing.

Rent or lease property instead of outright purchase or sale.

Referring to a fund, be partially invested.

Principle 17. Another dimension

Dimension in "Financial Space" refers to different markets or sectors:

Different financial markets, e.g., stocks, corporate bonds, municipal bonds, treasuries, commodities, etc;

Different regional markets for same securities or commodities;

Different industry sectors.

Use diversification.

Businesses

Portfolios

Explore different markets.

Find a buyer who will pay more or offer better terms.

Sell product to different customers or markets, in order diversify and reduce risk.

Find a seller who will charge less or offer better terms.

Buy inputs from different suppliers or markets, in order to diversify and reduce risk.

Use arbitrage.

Transactions separated in "space" (regions, markets, or sectors), and synchronized in time, usually to take advantage of differences in price.

Buy corn in Chicago; sell corn in St. Louis.

Principle 18. Mechanical vibration

No examples found. See Principle 19 - periodic action.

Principle 19. Periodic action

This principle refers to repeating actions, usually having regular time intervals, taken to accomplish a purpose. See also, Principle 14.

Instead of single or continuous action, use periodic actions.
Pay off a loan with a series of periodic payments, rather than a lump-sum at the end of the loan term.

If an action is already periodic, change the periodic magnitude or frequency.
Pay off a loan having monthly payments, with two payments (or half-payments) per month.
Increase the frequency of compounding of interest, e.g., quarterly to monthly or even daily.
Increase the frequency of asset turnover.
Increase the value of assets and/or the profit margin being turned over.

Use pauses between actions to perform a different action.
Make extra payments on a loan's principal.

Principle 20. Continuity of useful action

Carry on work continuously; make all parts of an object, process, or activity work at full load, all the time.
Continuous compounding of interest.
A perpetuity.
Where market conditions permit, be fully invested in a fund.

Principle 21. Skipping / rushing through, or high speed

Conduct a process or activity, or certain stages (e.g. beneficial, expensive, or high-risk steps or operations) at high speed.
Use accelerated cost-recovery schedules.
Pay off a loan early.
Make larger payments on a loan than required, in order to pay it off early.
Call a bond or note (i.e., pay it off early).

Principle 22. "Blessing in disguise" or "Turn Lemons into Lemonade"

Use harmful factors (particularly, harmful effects of the environment or surroundings) to achieve a positive effect.
Take short positions in a declining market.
When interest rates rise substantially, negotiate a discount of principal in exchange for paying off a low-interest loan early.
Buy back stock when the price is low.
Call bonds or pay off fixed-rate loans when interest rates have fallen; and refinance.

Eliminate the primary harmful action by adding it to another harmful action to resolve the problem.
Faced with a hostile takeover, find a "white knight" or "white squire" to complete a less-undesirable merger or limit the effects of loss of control.
Activate "poison-pill" or other takeover defenses.

Amplify a harmful factor to such a degree that it no longer is harmful.
Old saying in finance:
"Borrow ten thousand dollars from the bank, and the bank owns you; borrow ten million dollars, and you own the bank!"

Principle 23. Feedback

Introduce feedback (referring back, cross-checking) to improve a process or action.
Mark investments to market.
Take physical inventory of assets.
Use auditors.
If feedback is already used, change its magnitude or influence.

Create an internal audit committee who reports to the board of directors.
Use independent accounting firms or other outside auditors.

Principle 24. Intermediary

Use an intermediary agent.

Banks, savings-and-loans, and credit unions
Credit-card issuers
Online payment agents
Brokers
Leasing agents
Escrow agents
Fiduciaries
Trustees

Use an intermediary carrier.

Corporations
Investors & venture capitalists provide capital and assume risk in exchange for a share in potential growth and profits.
Trusts
Estates
Insurance underwriter accepts risk in exchange for a premium.
Options writer accepts risk in exchange for a premium.
Speculator accepts risk from the hedger in anticipation of future profit.

Use an intermediary process.

Use a "bridge loan", e.g., to buy another house while selling the existing house.

Merge one object, process, or activity temporarily with another (which can be easily removed).

Form a partnership.
Form a syndicate.
Form a joint venture.

Become the intermediary; others pay you to accept or manage risks for them.

Underwrite insurance.
Write options.
Speculation: Person who does not produce or consume the commodities takes future positions in the market, assuming the producer's or consumer's risk in anticipation of making a profit.

Principle 25. Self-service

Make a supplier or customer serve himself by performing or automating auxiliary helpful functions.

Automatic teller machines
Customer uses the cash-advance feature of a credit card for a short-term loan.
Utility company uses automatic funds transfer to withdraw payments from the customer's checking account.
Deliver banking, brokerage, and other financial services via telephone and internet.

Disintermediation: Eliminate the intermediary or middleman and perform the function.

Instead of buying government securities through a broker, open a Treasury Direct account and deal directly with the U.S. Treasury.
Set up an in-house finance unit, credit-card, or charge-card operation.

Use underutilized or idle assets.

Leveraged buy-out

Principle 26. Copying

Instead of an unavailable, expensive, fragile, or irreplaceable objects, use simpler, inexpensive, replaceable copies.

Gold and silver certificates (currency) were used in place of gold and silver coins.
Warehouse receipts are exchanged instead of the physical commodities.
Use checks or money orders instead of cash.

Replace an object or process with an optical copy.

Banks now print check images on statements instead of returning cancelled checks to their customers.

Replace an object or process with a mathematical or statistical copy.

A market index models the performance of a broader market.
A market-index derivative replaces a portfolio containing all the securities tracked by the index.

Principle 27. Cheap short-lived objects

Short-term rent or lease instead of buying.
Short-term loan.
Short-term investments with low, or no transaction charges, e.g. 1-month t-bills.
Use a "bridge loan", e.g., to buy another house while selling the existing house.
Use options - to control risk for a limited time.

Principle 28 Mechanics substitution

Use credit, debit, or money cards instead of physical cash or checks.

Replace cash, securities, or other assets or goods with book-entry transactions.

Savings and brokerage accounts
Cell phone minutes

Use prepaid electronic cards denominated in a particular commodity, or in the issuer's selection of goods.

Gasoline cards
Telephone calling cards
Gift cards

Use wire or electronic means to transfer funds.

Principle 29. Pneumatics and hydraulics

No examples found.

Principle 30. (Flexible shells and thin films) Flexibility

Flexibility refers to the terms of transactions, agreements, financial instruments, portfolios, and the like.

Mutual consideration: "My terms, your money", or "My money, your terms".

Trade off money vs the terms of a transaction. Terms relate to any consideration of value to the other party.

Time or activities:

Services or opportunities

Money:

Financing or other structure of the transaction

Risk.

Provide optional features in a security or transaction.
Issue warrants.
Structured debt.

Isolate postions, transactions, or operations from the external environment using flexible terms.
Revolving line of credit.

Change the degree of flexibility.

Principle 31. Porous materials

No examples found.

Principle 32. (Color changes) Allocation

The financial analogy of "color" is the purpose for which money is allocated or budgeted; from the expression, sometimes used in contracting, "color of money". [3]

Change the allocation of funds.
When permissible, reallocate funds from one purpose, account, or budget to another.

Change the external environment.
When structuring a contract or agreement, allow (or disallow) the possibility of full or partial reallocation of funds among all or some of the accounts.
Renegotiate a contract to permit such reallocations.

Principle 33. Homogeneity

Make objects interacting with a given object of the same material (or material with identical properties).
Conduct business in the local currency.

Principle 34. Discarding and recovering

Time:
Use idle assets at a different time, if the cause of idleness is timing or conflict with other activities, and other times are available (e.g., night shift).

Money/assets:
Make portions of an asset that have fulfilled their functions go away.
Dispose of obsolete assets or parts of assets by selling, scrapping, demolishing, or donating; then write them off.
Re-use idle or obsolete assets elsewhere in the operation, or at another location.

Rent or lease assets to others during planned idle time.

Conversely, restore consumable parts of an asset, or the value thereof, directly in operation.
Set up depletion accounts.
Apply straight-line or accelerated cost recovery (depreciation).
Overhaul, rework, or refurbish assets to extend their useful life.
Upgrade or convert inefficient, obsolete, or unusable assets into usable assets (perhaps saving the higher cost of purchasing new).

Risk:
Remove exposure to risk as soon as the need for the source of the risk has passed.

"Stand aside" during volatile or directionless market conditions; reinvest when a new trend has appeared.

Principle 35. Parameter changes

Time or activities:

Convert ownership to "estate for years" (or vice-versa).

Sell a building or facility and lease it back.

Money:

Convert short-term gains to long-term gains (or vice-versa).

Convert from taxable to tax-exempt (or vice-versa).

Convert from one currency to another.

Risk:

Change the degree of risk; e.g., change the volatility; reduce variance.

To increase the profitability of a trading program or business, reduce the variance of the returns. **[10c]**

Exercise a financial instrument's contingent or convertibility features:

Bonds convertible to common stock.

Exercise an option to buy stock.

Time and money:

Convert a fixed sum of money to a stream of income (or vice-versa).

Buy or sell an annuity.

Time, money, and risk: Refinance

Time:

Shorter or longer term

Fully-amortizing or balloon-payment loan

Change the payment schedule.

Money:

Lower or higher interest rate

Lower or higher payment

Fixed or variable rate loan

Risk:

Secured or unsecured loan

Loan as a percentage of equity

Payment as a percentage of income

Principle 36. (Phase transitions) Liquidity

The best financial analogy of "phase" is liquidity, which is the ease with which an asset or security may be bought or sold in the market. Liquidity can change with time and conditions in the market or economy.

Convert less-liquid assets to more-liquid assets, or vice-versa.

Factoring:

Buy or sell receivables for cash.

Use phenomena occurring during phase transitions; e.g., low-liquidity assets tend to be less valuable than similar assets of higher liquidity.

Buy failing or bankrupt companies and turn them around - thereby increasing value.

Buy at a discount, debt in or near default and negotiate a "work-out" plan.

Provide liquidity.

Make a market, e.g., in stocks.
Convert assets for others and collect commissions and fees for the services.

Principle 37. (Thermal expansion) Relative change

Relative change refers to differing changes in risk, variance, volatility, or price; or to changes in other parameters (e.g., value) resulting from these.

Money and risk:
Utilize changes in value resulting from changes in volatility of a security or option.
Premium value of an option increases in volatile market conditions; decreases in calm market conditions.

Time and money:
Utilize relative changes relating to time.
Options nearing expiration change time-value more quickly than options with significant time remaining.

Utilize relative changes across financial space (e.g, markets).
Arbitrage
Spread positions
Negative correlation **[4] [10a]**

Principle 38. (Strong oxidants) High-risk environment, market, or position

The financial analogy of strong oxidants or reactivity is high risk, high volatility, or high return. It is the opposite of "inert" as defined in Principle 39.

Take higher-risk, higher-potential-return positions.

Add higher-risk, higher-potential-return positions to a portfolio.

Accept risk for others:
Underwrite insurance.
Write options.
Speculate.
Invest in companies or ventures.

Principle 39. (Inert environment) Low-risk environment, market, or position

"Inert" in the financial sense, refers to low risk, low volatililty, or low return.

Take lower-risk, lower-potential-return positions.

Add lower-risk, lower-potential-return positions to a portfolio.

Replace a normal environment with an inert one.
Take a cash position in a portfolio.
Take a position in "risk free" securities, such as U.S. Treasury securities.

Find others (intermediaries) who will accept risk:
Buy insurance.
Reinsurance
Buy options.
Hedge.
Find investors for your venture or business.

Add "neutral" or "inert", i.e, zero-risk, positions to a portfolio.

Holding a portion of a portfolio in "risk free" securities can increase overall returns while lowering risk.
[4] [10a]

Principle 40. (Composite materials) Composite structure

"Structure" refers to the composition of a portfolio; terms of an agreement or loan, etc.

Change from uniform to composite.
A loan with a "balloon" payment.

Composite financial instruments:
Bonds convertible to common stock.
A charitable gift annuity:
Pays income during beneficiary's life.
Income consists of taxable and non-taxable components.
The remaining principal goes to charity at beneficiary's death.

The Equivalence Principles of Finance

The three domains of finance are time, money, and risk. The Equivalence Principles of Finance are:

Time and money are equivalent;
Risk and money are equivalent; and
Time and risk are equivalent (this is the corollary of the first two).

These principles can be summarized as, "Time is money; risk is money; time is risk".

Time and Money are equivalent.

"Time is money". Time includes: human effort; time an asset is held or carried; time an asset is available for use; time during which an action may be taken (opportunity); time during which there is exposure to risk; calendar-time required to accomplish a task; and delay. Money includes price, cost, investment, and return.

Time value of money:
The "zero-risk" interest rate (excluding risk and inflation components) is the "rent' price paid for the use of money.
A future dollar is discounted.
Option premiums have a time-value component.
Carrying costs are proportional to time.

Trade off time for money, or vice-versa:
Moving transactions in time has value - e.g., the cost to refinance or reschedule debt.
Move, rearrange, or distribute financing, investments or activities in time to reduce cost.
Pay others to perform services for you, in order to free up time or avoid delay.
Perform services for others, converting available time to money.

Delay propagates through downstream activities.
Use premium time (overtime, weekends, holidays) to shorten activities on the critical path of a project.

Risk and Money are equivalent.

"Risk is money". Risk includes variance, volatility, and probability, i.e. the different ways events or scenarios can occur. Risk exposure occurs over a period of time.

Types of risk:

Time- and activity-related:

Risk related to passage of time
Risk related to the synchronization of activities (e.g., missed deadlines)
Risk related to adverse side-effects of beneficial activities
Risk related to adverse external events

Money-related:

Risk related to money, assets, and the holding thereof

Financial space-related:

For example, sector or company-specific risk vs market risk

Risk value of money:

Interest rates have a default risk component.
Interest rates have an inflation risk component. This component is fixed for fixed interest rates; while inflation can change increase over time.
Borrowers can default. Collateral can become impaired.
Option premiums have a risk component.
Insurance premiums are payments for acceptance of risk.

Each activity has its own associated risk.

Eliminate, shorten, or lengthen activities (as appropriate) to reduce risk.

Risk propagates through downstream activities.

Minimize risk associated with critical-path activities of a project.

Share risks with others.

Mutual insurance
Form a syndicate.

Trade money for risk - pay others (intermediaries) to accept risks.

Buy insurance.
Use re-insurance techniques.
Buy options.
Hedging: Producer or consumer of commodities takes future positions in the market to cover expected production of, or demand for, a commodity, in order to fix the price and minimize risk.

Trade risk for money - become the intermediary; others pay you to accept or manage risks for them.

Underwrite insurance.
Write options.
Speculation: Person who does not produce or consume the commodities takes future positions in the market, assuming the producer's or consumer's risk in anticipation of making a profit.

Time and Risk are equivalent.

"Time is risk". Corollary of the first two Equivalence Principles.
Increasing time may either increase or decrease risk, depending on the situation. Use this principle to work in the time and risk domains to minimize the need for money, or to increase returns.

Use critical-path method to identify and understand time-related risk in projects.

Can the timeline be reconfigured to take high-risk activities off the critical path?

Shorten or eliminate activities where delay could allow conditions to change unfavorably.

Allow sufficient time to properly complete critical activities; avoid rework.

Quickly complete activities (Principle 21) to minimize exposure to outside risk.

Move, rearrange, or distribute financing, investments or activities in time to reduce risk.

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[5] Darrell Mann, Simon Dewulf, Boris Zlotin, and Alla Zusman, Matrix 2003 Updating the TRIZ Contradiction Matrix, CREAX Press, Ieper, Belgium, 2003. See the Matrix for its categorization; and pages 122-126 for the combined and special principles.

[6] Yuri Salamatov, TRIZ: The Right Solution at the Right Time, Insytec B.V., Hattem, The Netherlands, page 233.

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[10] Ralph Vince, Mathematics of Money Management, John Wiley & Sons, New York, NY, 1992:
(a) efficient portfolio, pages 40-41
(b) optimal f, pages 32-33
(c) variance of returns, and fundamental equation of trading, pages 53-62

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